Work Assignment No. 6
MTA Agreement No. 15099-0300

Utica Avenue Transit Improvements Study

Task 2 Deliverable 5: A-Division Train Storage Yards

December 2020

Prepared for:

MTA New York City Transit

Submitted by:

WSP

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1 Executive Summary

To support increased A-Division revenue service arising from the introduction of Communications-Based Train Control (CBTC), additional storage yard capacity may be necessary throughout the division. With more trains running during peak periods, additional train storage may be needed during off-peak periods, especially the overnight hours. This could further strain the already heavily utilized train storage yards and maintenance facilities on the system. With most of the existing A-Division yards located in the Bronx and in Upper Manhattan, constructing additional train storage locations in Brooklyn for midday layover and overnight storage would offer operational benefits in addition to providing additional storage capacity.

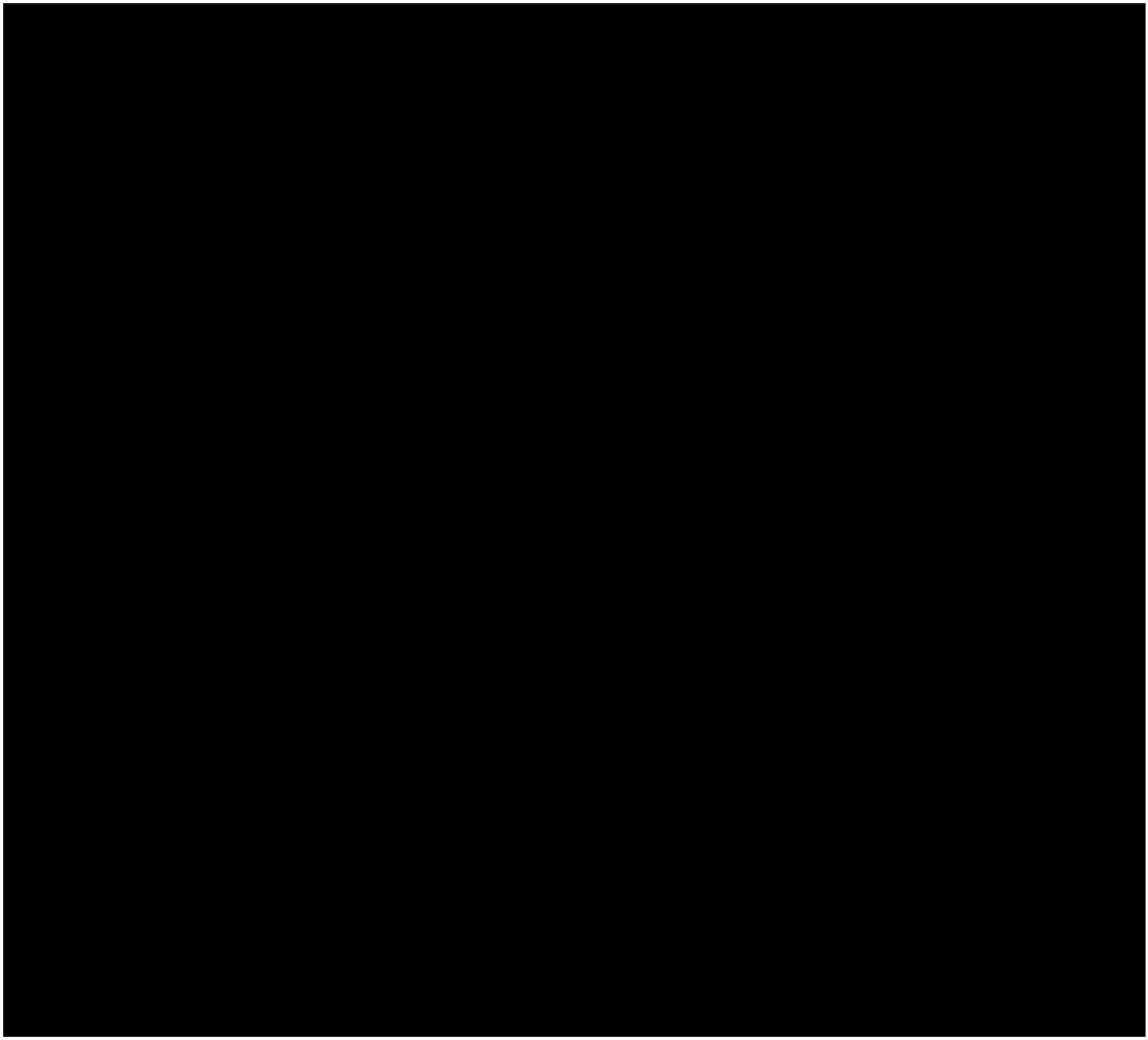
As part of Task 2 in the Utica Avenue Transit Improvements Study, this report is focused on adding train storage at and in the vicinities of Livonia Yard and Linden Yard to create additional and more geographically evenly distributed train storage capacity throughout the A-Division. The opportunities identified in this report complement the recommendations for new and expanded storage locations identified in other Task 2 reports regarding improvements at Flatbush Av Terminal and Crown Heights-Utica Av Station. Each site discussed in this report could support expanded train service that could operate on the Nostrand Av, Eastern Parkway, and New Lots Av Lines.[1]

A guiding principle of the Study Team's effort was that the proposed concepts must be constructible and cost effective, and should limit potential impacts upon both revenue and non-revenue subway service during construction. Additionally, where private property is needed to enable new or expanded train storage spaces, efforts were made to avoid residential property acquisition, minimize impacts upon residential property, and minimize the number of affected commercial property owners. The construction of additional train storage space would require environmental analysis, clearances, and possibly mitigation; these have not been analyzed at this conceptual stage and the extent of such requirements are not part of the scope of this report. Additionally, the proposed storage yard concepts presented herein have not calculated the space needs required for staff support facilities for such divisions as Service Delivery, Car Equipment, or Maintenance of Way (MOW). If such facilities are required, a space needs assessment would need to be performed and appropriate locations would need to be identified.

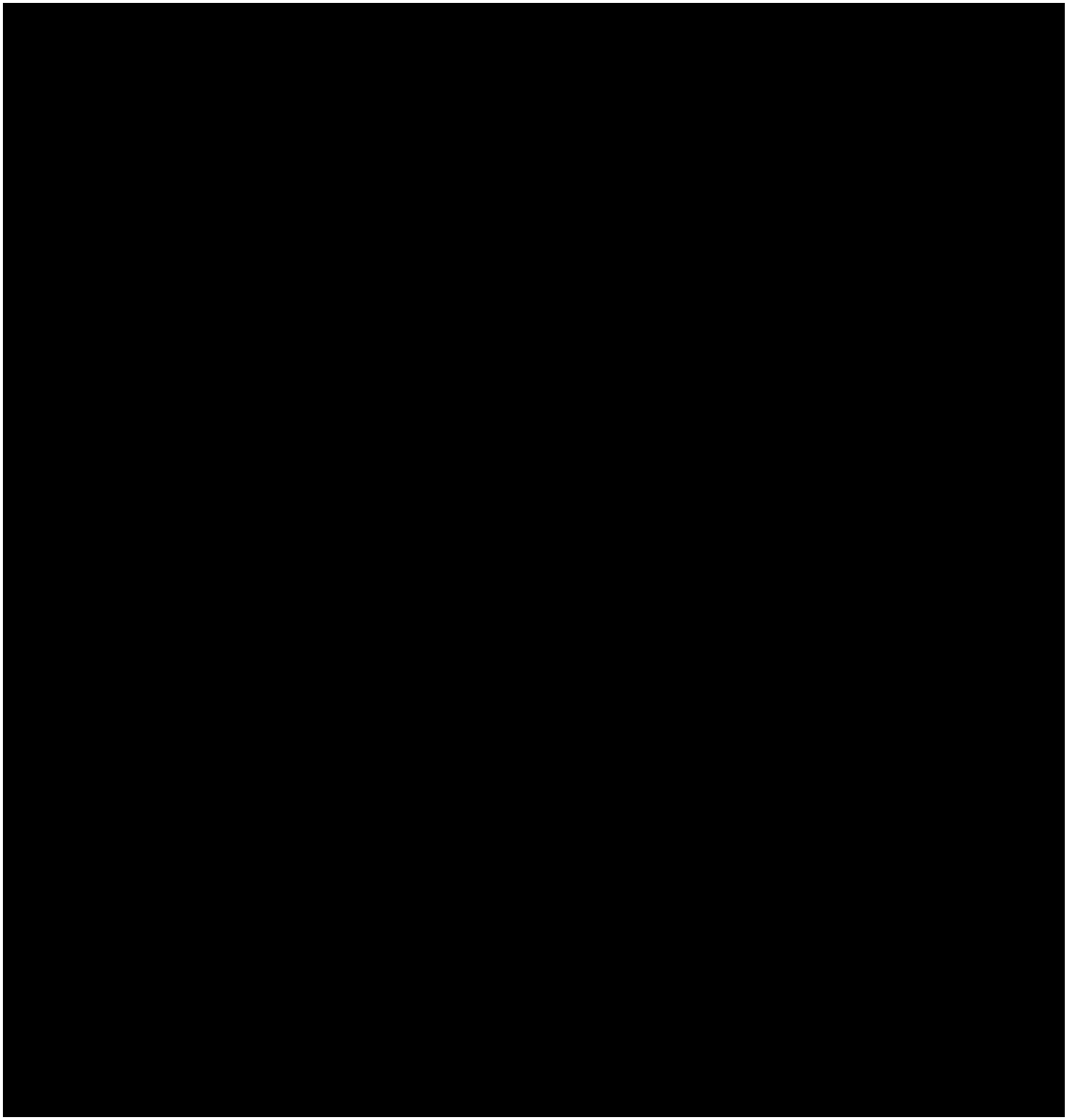
In this report, the Study Team identified and evaluated opportunities to increase overall train storage at Livonia Yard, Linden Yard, the Long Island Rail Road (LIRR) Bay Ridge Branch adjacent to Linden Yard, and two new sites south of Livonia Yard. The Study Team sought to optimize the layout and number of trains that could be stored at each site, with the overall intent to provide additional storage in the southern A-Division service area to accommodate an expanded subway fleet.

[1] Although this report was intended to find methods to bolster existing A-Division train storage capacity at southern locations along the A-Division, it may also be possible to store trains assigned to a future Utica Avenue Subway Extension at some of these locations as well. This would depend upon which sites and alternatives were selected and advanced, how much of that storage capacity would be used by existing A-Division subway routes, and how much "surplus" storage capacity remained.

Appendix B of this report provides order-of-magnitude estimates of construction duration and capital cost for each of the identified concepts. A total of 16 concepts are presented in this report, from which the Study Team recommends the following concepts:



[2] It was noted by NYCT Car Equipment that an added benefit of this concept would be that the existing shop could remain in operation while the new shop is being built, which would have a positive benefit on Car Equipment operations as staff or activities would not need to be relocated. However, NYCT also noted that this scheme was unlikely to work with the existing shop being in service continuously due to site-specific constraints, which are discussed in the main body of this report.



The improvements recommended above could be implemented individually, in packages, or all at once, depending upon how many train storage spaces are required, where they are required, NYCT resources and funding, and other factors such as combining implementation with other major work to minimize subway service impacts. Implementation of any of these recommended improvements would be beneficial for subway operations, fluidity, and service resiliency, thereby advancing the overarching goals of the Utica Avenue Study.

As a subsequent step in this study, the Study Team will determine—in coordination with NYCT and the Steering Committee—whether the recommendations contained herein should be included in the Final Investment Packages in Task 5 (including consideration for transit improvements along Utica Ave). Regardless of whether the improvements are included in the Final Investment Packages, they still have independent utility and can be advanced by NYCT beyond this study.

If any of the improvements identified in this report are advanced beyond this study, the concepts would need to be revisited in a subsequent design phase, including the basis of estimate for capital cost and construction duration as well as the conservative assumption of a design-bid-build contracting method.[3]

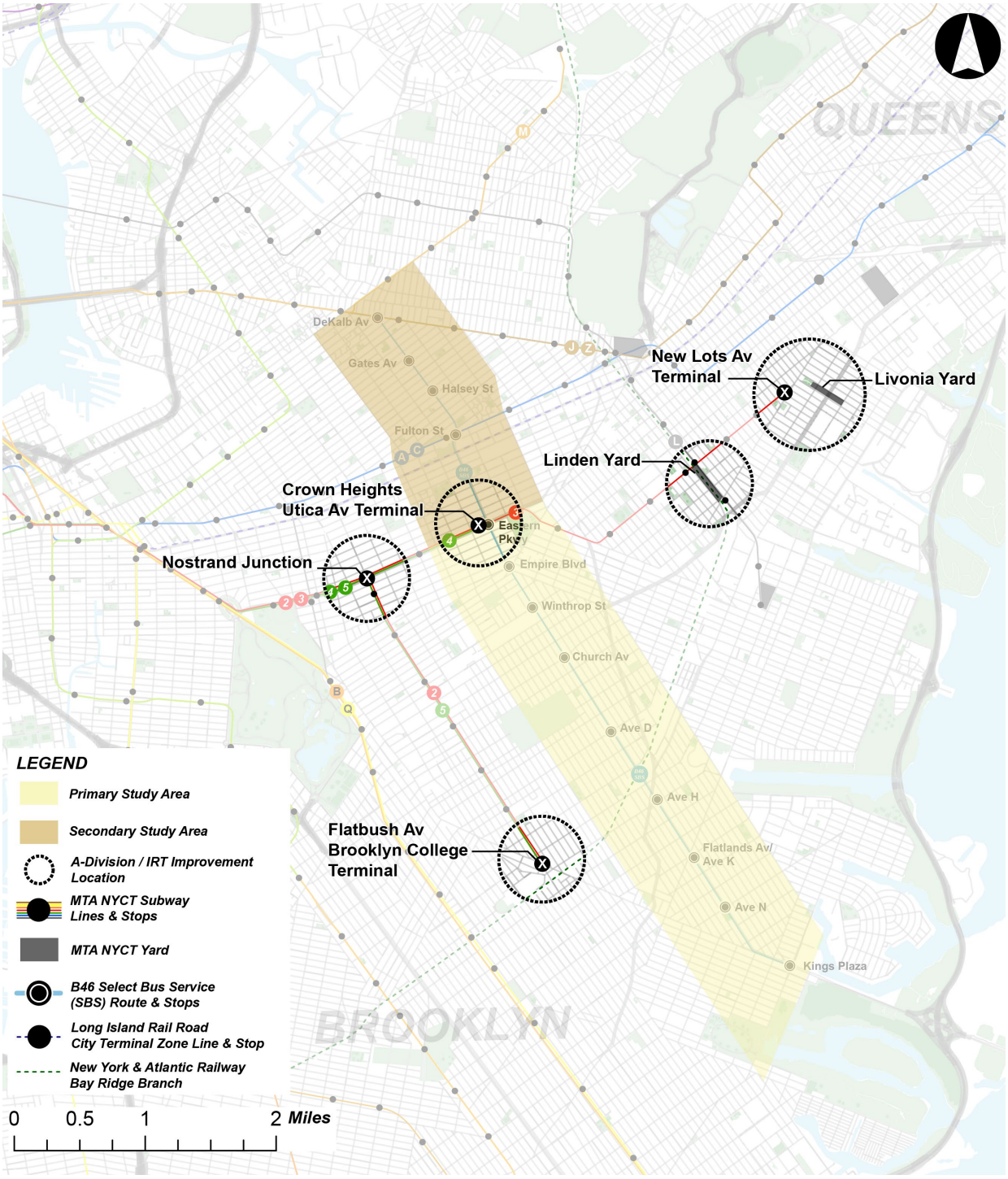
[3] The estimates of capital cost and construction duration prepared throughout the Utica Ave Study conservatively assumed a design-bid-build contracting method. A number of potential efficiencies could be realized through a design-build contracting method, including the prospect of shortening project schedules. The potential reduction in the overall duration of design and construction could, in turn, lead to a reduction in the capital cost estimate for a given project, as escalation is determined based on the midpoint of construction. Additionally, the owner could realize potential cost savings in the form of reduced administrative and management costs (due to improved coordination between the design and construction work) as well as reduced construction costs arising from Alternative Technical Concepts that can leverage the expertise and experience of each design-build proposer. Overall, as noted in the Metropolitan Transportation Authority (MTA) 2020-2024 Capital Program, the use of a design-build contracting method can "rebalance the risk equation between the MTA and its contractors." Section 1264 of the New York Public Authorities Law calls for "the use of design-build contracting on all projects over twenty-five million dollars in cost except where a waiver is granted by the New York state budget director pursuant to a request in writing from the metropolitan transportation authority." As such, the use of design-build contracting—and the specific efficiencies that could be realized—should be revisited for any concept that is advanced beyond this study.

2 Introduction

As part of Task 2 in the Utica Avenue Transit Improvements Study, this report addresses opportunities to increase train storage at and in the vicinities of Livonia and Linden Yards. Additional reports completed as part of Task 2 address other stand-alone study locations where operational and capacity improvements could be made to the existing subway system that are complementary to but independent of any potential transit improvements along the Utica Avenue corridor. Overall, the intent of these study locations is to identify methods to increase the existing A-Division capacity and operational flexibility in eastern Brooklyn and to offer a range of solutions to alleviate existing constrained conditions pertaining to train operation bottlenecks and a shortage of train storage or lay-up capability. The other study locations are Nostrand Junction, Flatbush Av Terminal, Crown Heights-Utica Av Station, and New Lots Av Terminal (Figure 1).

To support increased revenue service arising from the introduction of Communications-Based Train Control (CBTC), additional storage yard capacity may be necessary. This report adopts an approach of identifying and investigating sites along the A-Division subway lines in Eastern Brooklyn for possible use as new or expanded train storage facilities and then devising methods to optimize the layout and number of trains that could be stored at each site. The overall intent is to provide additional storage in the southern A-Division service area to accommodate an expanded subway fleet. The sites for additional train storage discussed in this report are in addition to those addressed in separate deliverables completed in Task 2 for Flatbush Av Terminal and Crown Heights-Utica Av Station.

Figure 1: Study Area and A-Division Improvement Locations for the Utica Avenue Transit Improvements Study



Source: Utica Ave Study

3 Existing Conditions and Constraints

3.1 EXISTING INFRASTRUCTURE AND OPERATIONS

Trains assigned to the A-Division subway routes are stored at different yard locations across multiple sites in the Bronx, Manhattan, Queens, and Brooklyn. These sites include:

- Westchester Yard (Bronx);
- 239th Street (Bronx);
- Jerome Yard (Bronx);
- East 180th Street-Unionport Yard (Bronx);
- Unionport Yard (Bronx);
- 240th Street Yard (Bronx);
- Lenox Yard (Manhattan);
- 137th Street Yard (Manhattan);
- Corona Yard (Queens); and
- Livonia Yard (Brooklyn).

In addition, there are other locations, such as pocket tracks located along mainline tracks and tail tracks located beyond terminal stations (e.g., the tail tracks beyond Crown Heights-Utica Av Station), which can store a small quantity of trains.

As the above list indicates, a disproportionate number of A-Division trains are stored in the Bronx or in Upper Manhattan. To provide additional and more geographically evenly distributed train storage capacity throughout the system, this report is focused on adding train storage at or in the vicinities of Livonia Yard and Linden Yard. Livonia Yard is the only major train storage yard located at the southern end of the A-Division, and Linden Yard is currently serving as a facility used by Maintenance of Way (MOW). The Long Island Rail Road (LIRR) Bay Ridge Branch adjacent to Linden Yard, as well as two sites near Livonia Yard, are also evaluated for opportunities to increase overall train storage. The existing uses of these sites are discussed in the following sections, and proposed improvements are discussed in Section 5.

3.1.1 Livonia Maintenance Facility and Storage Yard (Livonia Yard)

Livonia Yard is the sole A-Division facility in Brooklyn for train storage and maintenance. This facility is located subway south of New Lots Av Terminal,[4] bounded by Hegeman Avenue, Linwood Street, Stanley Avenue, and Elton St, and spans Linden Boulevard (Figure 2). The entire yard and shop building is elevated; the track level is approximately 20 feet above the sidewalk level on a retained fill structure (Figure 3). The yard lead tracks and yard throat tracks are on an elevated structure north of Hegeman Avenue.

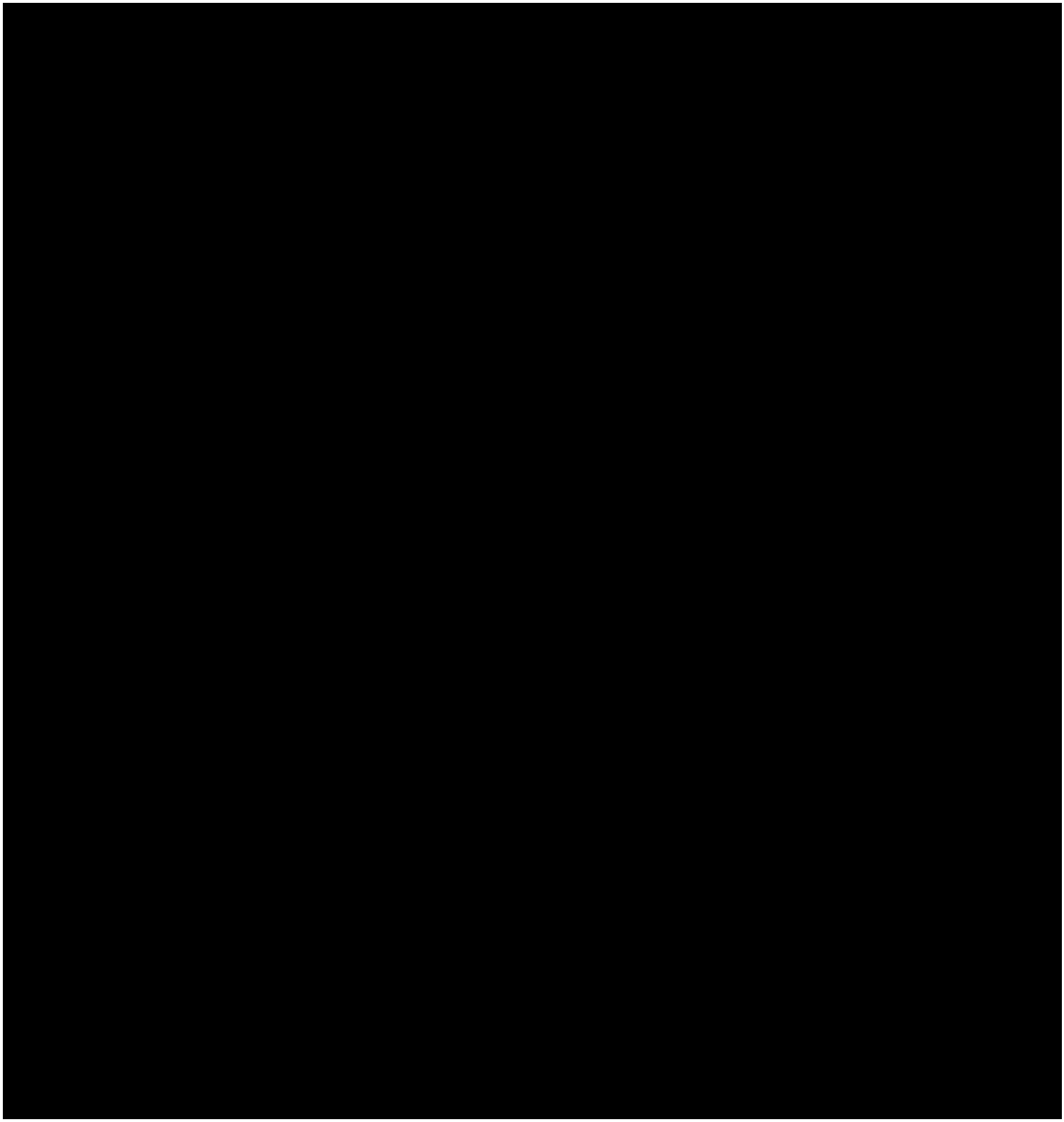
This yard currently has a capacity to store 15 10-car trains on 13 tracks. Its primary function is to store and maintain the trains serving the 3. It also stores and maintains a small quantity of 2, 4, 5 and S (42nd Street Shuttle) trains. Train cleaning, inspection, servicing, and in-situ maintenance is performed in the yard, with heavier repairs taking place at either the 207th Street or Coney Island Overhaul & Repair Shops.

The storage tracks are located along the west side and center of the property; adjacent to the storage tracks and on the east side is a four-track maintenance shop. This building dates to the original construction of the New Lots Av Line in the 1910s. Each track inside the maintenance facility (the "barn") can accommodate one 10-car train, where trains receive routine, periodic maintenance and servicing. The tracks within the shop are closely spaced and are not spaced to modern NYCT standards. This substandard track spacing limits clearances between adjacent trains and inhibits workers in the performance of their duties and ability to operate heavy and motorized equipment such as forklifts between trains. Additionally, vertical clearances within the existing Livonia Shop are constrained, as the shop in its current configuration cannot install or remove rooftop HVAC units that are part of the newer "Millennium Fleet." While this is not currently an issue because Livonia Shop services R62s and R62As, the scheduled replacement of this fleet will render the maintenance shop functionally obsolete.

With the useful life of this building nearing its end and with the modern maintenance procedures currently in use, there are plans to renovate or replace this building. As of fall 2019, conceptual planning of a new facility was in progress (see Section 4.1).

The storage yard is at capacity and the maintenance shop is in constant use, with little to no surplus capacity to handle increased train storage. The planned shop renovation is expected to increase the footprint of the building, which would usurp some of the storage yard capacity. The potential reduction in the number of storage tracks is dependent upon the extent of the expansion of the shop footprint.

[4] In Eastern Brooklyn, there are three end-of-route A-Division stations that operate as terminals and are used to turn trains: Flatbush Av Terminal (served by the 2 at all times and by the 5 on weekdays); Crown Heights-Utica Av Station (terminal for the 4 train at all times except during overnight hours); and New Lots Av Terminal (terminal for the 3 train at all times except during overnight hours when the 4 train replaces the 3 train). Of the three terminal stations, only New Lots Av is directly connected to a storage yard (i.e., Livonia Yard). Furthermore, Crown Heights-Utica Av Station is "on the way to" New Lots Av while Flatbush Av is not, so a 4 train can be laid up by operating along the New Lots Av Line (either in revenue service or as deadhead) to New Lots Av and onward into the yard, while a 2 or 5 train cannot reach Livonia Yard without either short turning or making two awkward and capacity-constraining reverse moves, and in practice, both strategies are used.



3.1.2 Linden Yard and Shop

Linden Yard and Shop is the main facility for NYCT MOW equipment storage and maintenance. At this site, the equipment that maintains the infrastructure for the entire NYCT subway system (both A- and B-Divisions) is repaired, maintained, and stored. The yard is uniquely situated on a site with direct connections to both the A- and B-Divisions, as well as the national rail network. A ramped lead track provides access from/to the elevated New Lots Av (A-Division) and Canarsie (B-Division) Lines, which in turn connect to the rest of the NYCT subway system. A connection to the LIRR Bay Ridge Branch enables Linden Yard to receive deliveries via freight rail from across the country.

This site is split into two yards, Linden North and Linden South, as shown in Figure 4.

Linden North is primarily used for bulk storage and delivery of equipment and materials related to ongoing infrastructure projects. This area is also used by NYCT contractors, who use approximately three-quarters of the space.[5] With the track connections noted above, this yard offers an excellent site to efficiently stage and prepare for infrastructure projects and maintenance activities across the NYCT system. There are two tracks that are used to stage work trains that assist in delivering materials to different project job sites.

Linden South is where most of the staff are located. This section of the site contains equipment and material storage areas and is dominated by a large building where track panels and interlockings are assembled and where other track and switch repairs are performed. The building itself is a former school bus depot built in the 1960s and repurposed by NYCT for track panel assembly. There are four bays, each equipped with one or two gantry cranes with a capacity of 10 to 40 tons. One section is primarily used to maintain

[5] Per conversation with NYCT General Superintendent John Brown at Linden Yard on July 2, 2019.

mechanical equipment, while the rest of the building is used for track construction, including mainline track panels as well as special trackwork (i.e., switches, crossovers, track diamonds, etc.).

Outside, there are several tracks for storing work trains (i.e., locomotives and work cars) and other rail-borne equipment, a diesel fueling facility, a Continuous Welded Rail (CWR) fabrication shop, and a parking lot for employees. All tracks throughout Linden Yard are un-electrified.

Administrative offices are located in a smaller building west of the track panel assembly building.

South of the main track assembly building and adjacent to the LIRR Bay Ridge Branch is the CWR shop. Built in the 1990s, this is an approximately 1,600-foot-long by 10-foot-wide "shop on wheels," with all rail welding and grinding equipment mounted on railcars or on rubber-tired trailers. The shop takes 79-foot segments of rail delivered by truck or train and welds them into 390-foot-long "ribbon rail" strings; the 390-foot length is the longest permissible length to be transported within the NYCT system due to track curvature limitations. These ribbon rail strings are transported via work trains to the installation sites and then field-welded to create a continuously welded mainline track.

A significant third-party piece of infrastructure running through Linden Yard is the Buckeye Pipeline. This is a shallow pipeline buried along the southern and eastern boundaries of the site (approximately parallel to the Bay Ridge Branch).[6] This pipeline has two conduits, one which supplies jet fuel to the fuel tank farms located at JFK and LaGuardia airports and a second conduit carrying conventional diesel fuel to customers in Brooklyn and Queens. A major pipeline junction is located adjacent to the northern boundary of the Linden South site, along Linden Boulevard, where the main pipeline turns east toward JFK airport and a branch continues north under the Bay Ridge Branch.

The interchange track between the NYCT tracks and those of the national rail network is located at approximately the meeting point of Linden North and Linden South, north of Linden Boulevard.

[6] The Buckeye Pipeline was also discussed in the Task 2 report on Flatbush Av Terminal.

3.1.3 LIRR Bay Ridge Branch

The LIRR Bay Ridge Branch is a freight-only rail branch that extends from Fresh Pond Junction in Glendale, Queens in the north to the 65th Street Yard in Bay Ridge, Brooklyn to the south (Figure 5).[7] The right-of-way (ROW) is owned by the LIRR and freight service on this branch is operated by the New York & Atlantic Railway. This branch has connections to the national rail network via the CSX Fremont Secondary northward from Fresh Pond into the Bronx and a second connection via a car float operation across the New York Bay between Bay Ridge and Jersey City, NJ and points west. At Fresh Pond, there is also a connection to the LIRR Lower Montauk Branch that provides access to rail customers east on Long Island.

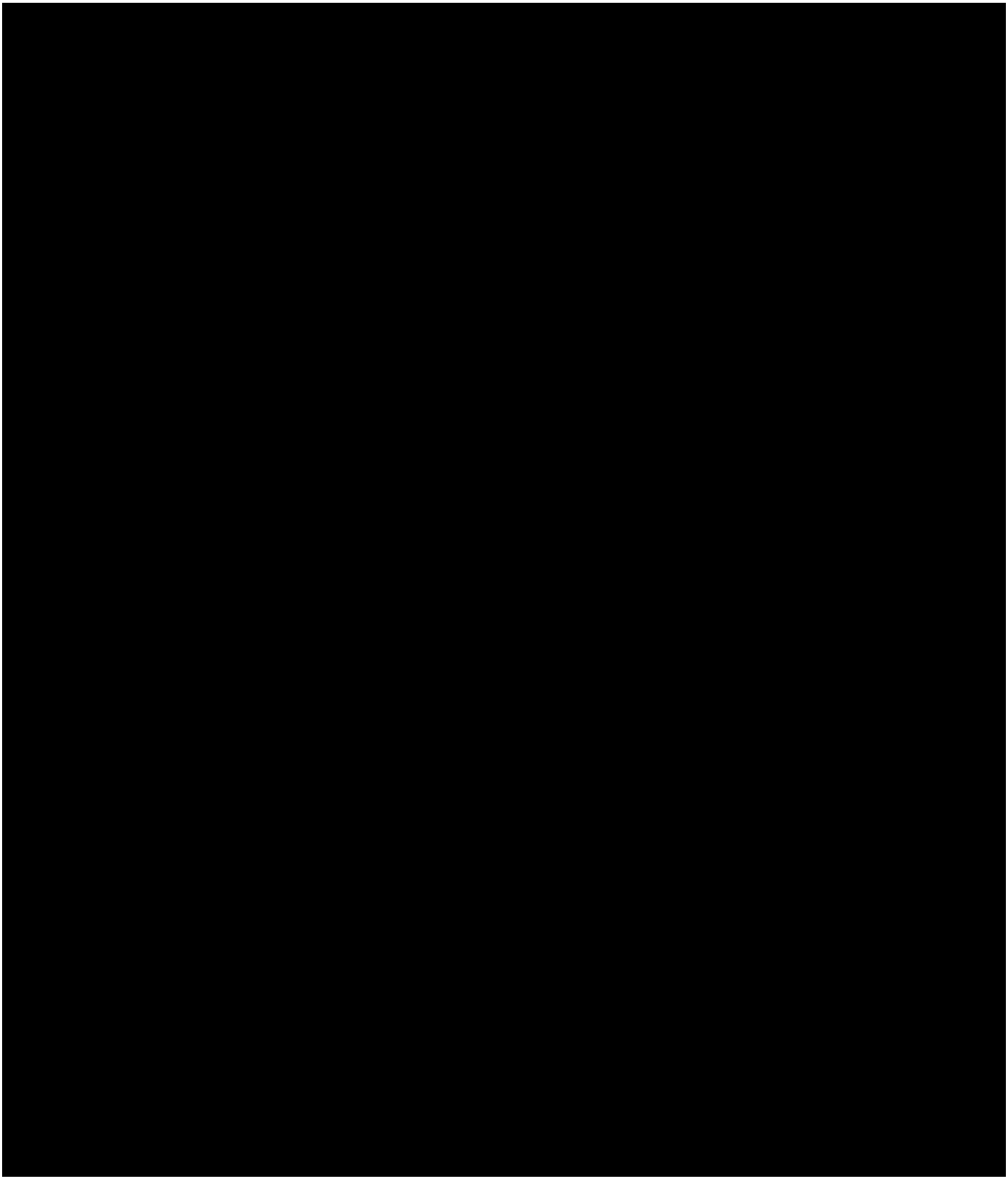
Figure 5: LIRR Bay Ridge Branch and Connections

Source: Port Authority of New York and New Jersey

The Bay Ridge Branch bisects or runs parallel to several NYCT subway lines, including the Sea Beach Line, West End Line, Culver Line, Brighton Line, Nostrand Av Line, New Lots Av Line, and Canarsie Line. The ROW width varies along the alignment. Although the ROW was designed to host multiple tracks, today it hosts only a single track with intermittent passing sidings; the rest of the ROW is generally overgrown with vegetation. The Buckeye Pipeline (mentioned above) is buried under portions of this ROW.

The segment of the Bay Ridge Branch from Linden South Yard as far north as Pitkin Avenue is a focus for this report as a possible subway train storage location, as discussed in Section 5.

[7] The Bay Ridge Branch near Brooklyn College was previously discussed as a possible storage yard location in the Task 2 report on Flatbush Av Terminal.



4 No Build Alternative

4.1 SITE-SPECIFIC CHANGES

As documented in the 2020-2024 MTA Capital Program, "larger-scale investments are planned at the Livonia Maintenance Shop…due to a high number of defective components and functionally obsolete layouts of the existing facilities that hamper their effectiveness…"[8] These planned investments supplement structural rehabilitation at Livonia Yard as programmed in the 2015-2019 Capital Program.

As of fall 2019, a separate NYCT planning effort that is underway to upgrade and modernize the Livonia Maintenance Shop was in the early conceptual design phases and the planning and design details were preliminary. In material supplied to the Utica Ave Study Team by NYCT in 2019, the new concepts propose decking over a portion of the yard and acquiring property.[9] The NYCT plan seeks to remedy the shortcomings of the existing Livonia Shop with respect to staff safety, car maintenance, and to meet the anticipated needs of the future A-Division R-262 fleet. The Utica Ave Study Team recommends that NYCT continue to coordinate the ongoing work to plan and design potential improvements at Livonia Yard.

In addition to the site-specific changes at Livonia Yard, the CWR shop at Linden Yard is slated to be relocated to a new facility to be built at Linden North. This would provide a permanent new facility as well as relocating this facility away from the Buckeye Pipeline, which runs near and under the existing CWR shop. The planning concepts described in this report for new train storage at Linden North take this CWR relocation into account.

4.2 COMMUNICATIONS-BASED TRAIN CONTROL

Fast Forward: The Plan to Modernize New York City Transit (Fast Forward Plan) is a 10-year look ahead plan that sets forth a vision to reimagine the subway system. A key element of the plan is the installation of CBTC signaling, which has been proposed to replace segments of the existing fixed-block signaling system. CBTC is considered more reliable than fixed-block signaling, offers train dispatchers more accurate train location information, has the potential to increase train speeds, and the ability to increase the number of trains running on each line.

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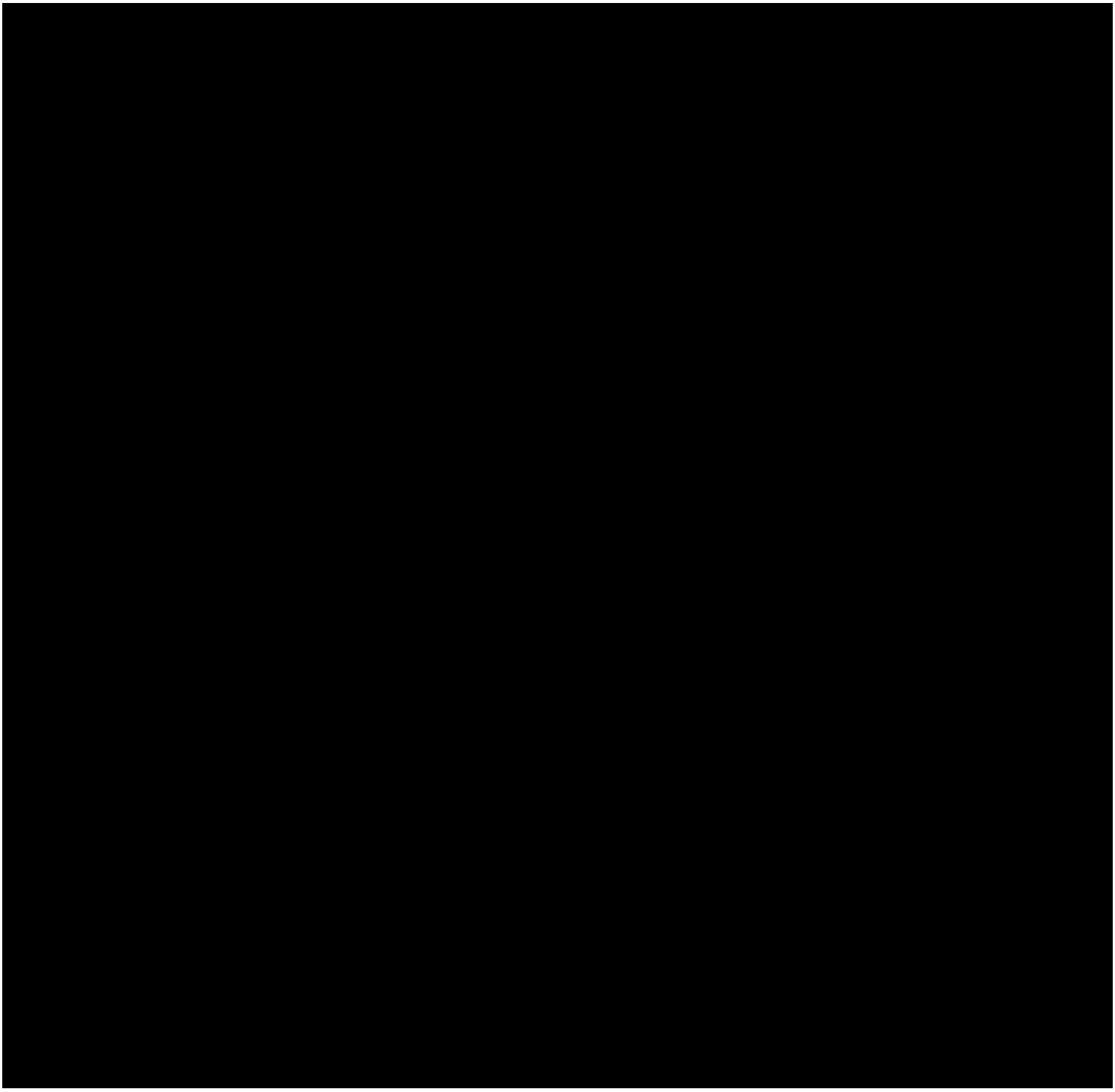
[8] It should be noted that if the existing maintenance facility were to remain in its current condition, this would have major implications on the ability to maintain future generations of subway cars and potentially an expanded car fleet. Additionally, the existing shop aisle widths do not provide staff with the required clearances that are up to modern safety standards; the narrow aisle widths do not permit small utility vehicles to access between repair tracks, and the limited vertical clearances inhibit access to and removal of rooftop components that are found on the newer subway cars. The overall effect is that the existing shop conditions reduce staff productivity and safety compared to newer or modernized NYCT shops, and also limit car availability and the ability to accommodate any future A-Division fleets at this location.

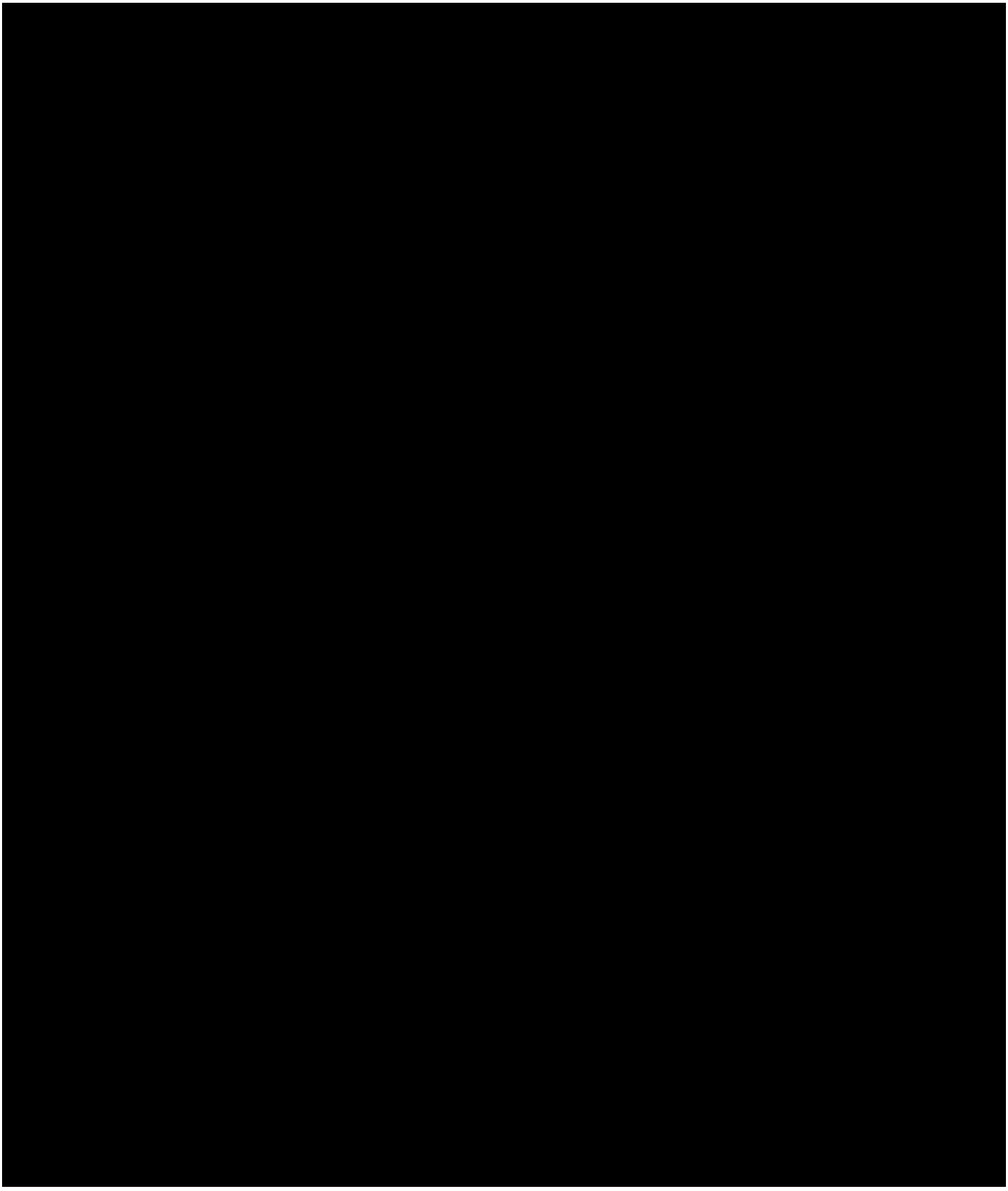
[9] One important difference with the concepts proposed by the Utica Ave Study Team in this report from those proposed in the separate NYCT planning effort (based on information provided by NYCT in 2019) is that the latter would require each 10-car train to be cut in half into 5-car trainsets to fit within a new maintenance shop, whereas each concept being proposed in this report would allow an intact 10-car train to be serviced within a new maintenance shop (as discussed in Section 5).

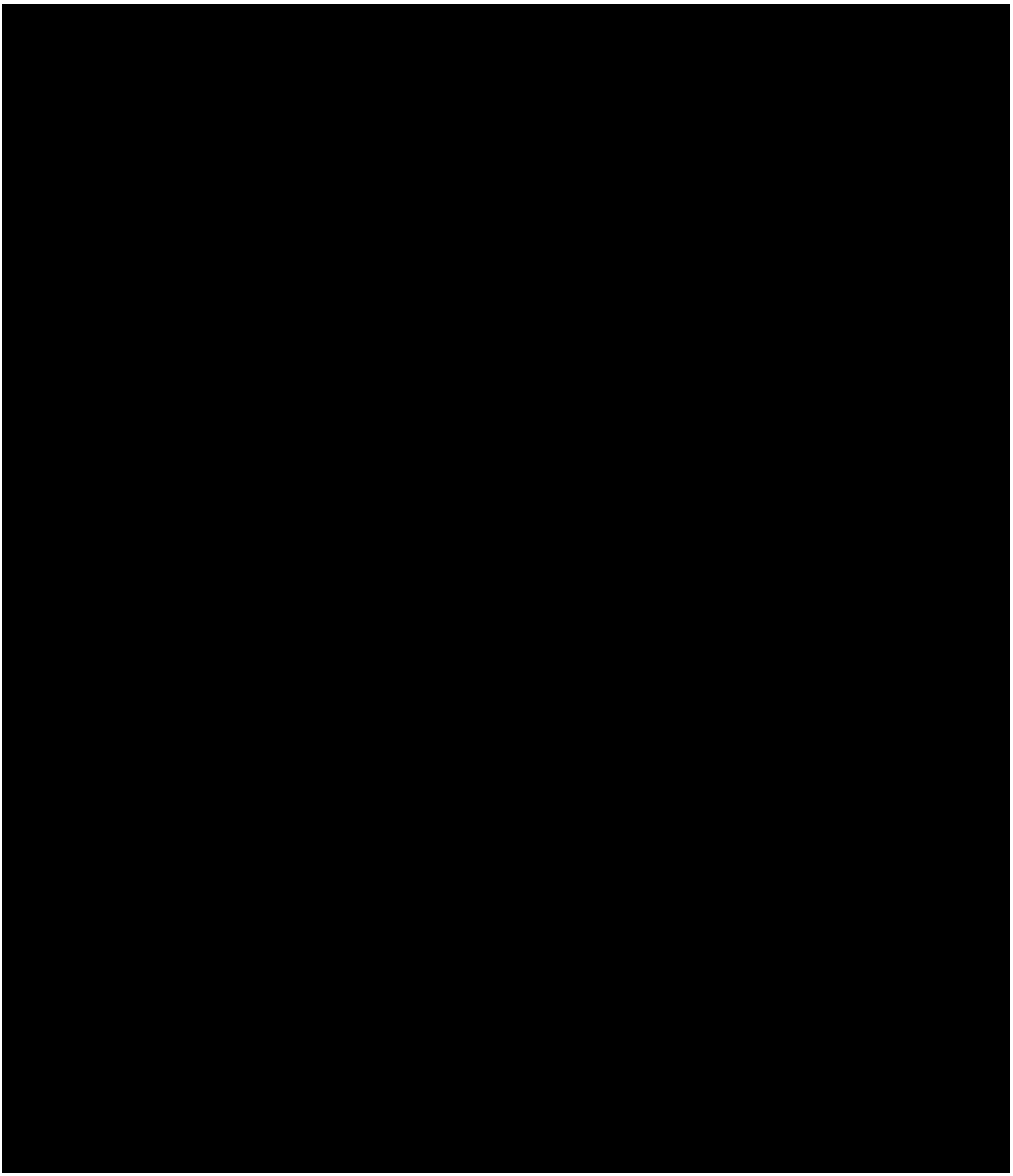
The installation of CBTC also has implications for train storage because the car fleet "spare factor" (i.e., extra trainsets beyond peak service requirements) is assumed to increase from the current 17% spare factor to 21% based on guidance provided by NYCT.

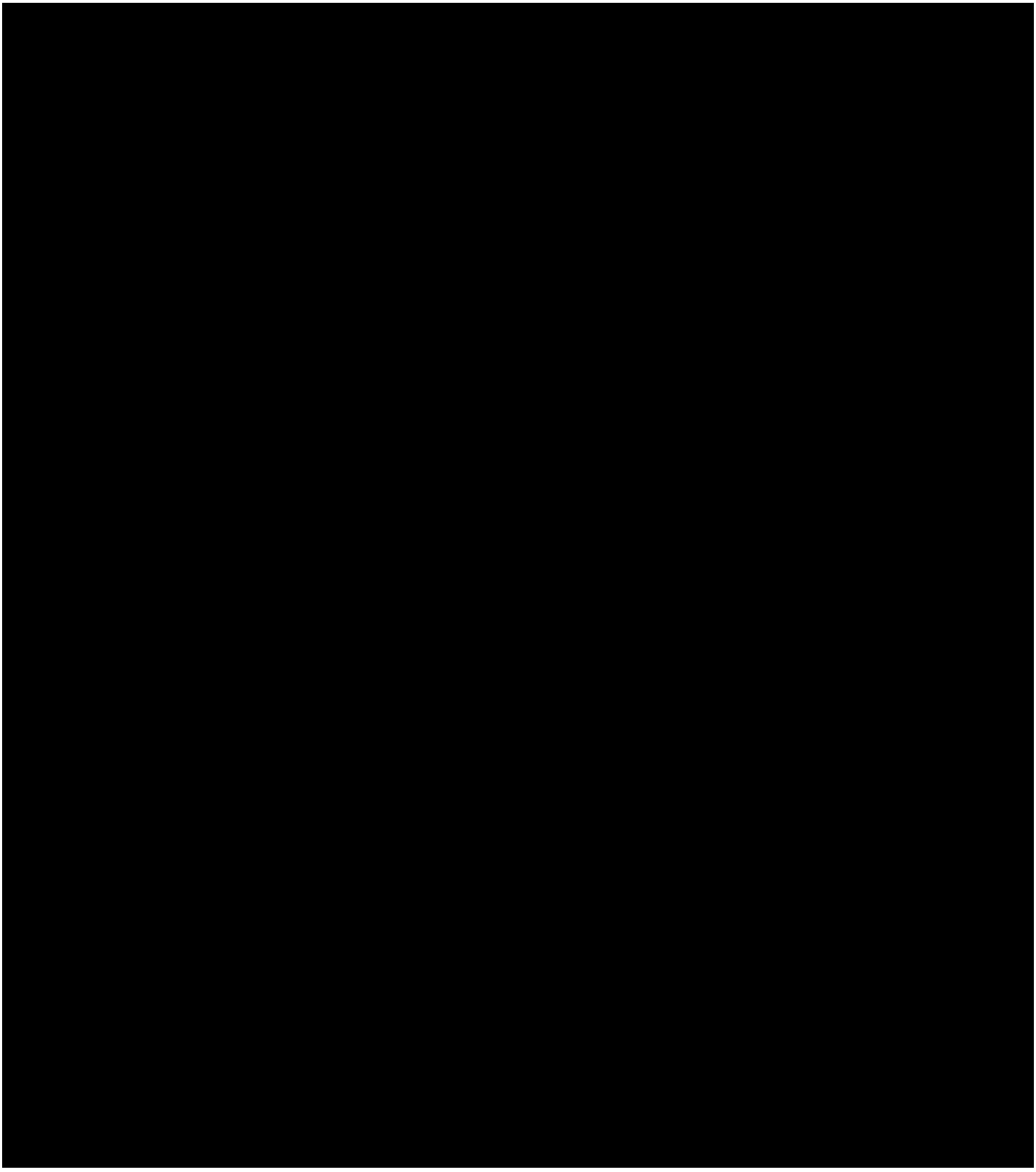
The Fast Forward Plan does not propose to install CBTC on the A-Division Lines east of Nevins Street Station in the first 10 years of plan implementation. However, the NYCT's A-Division Capacity Study includes train operations simulation analyses with CBTC installed and active throughout the Brooklyn A-Division Lines. Furthermore, NYCT has directed that the service plans and simulations to be performed as part of the Utica Avenue Study should use the A-Division Capacity Study simulation models with CBTC as a basis for evaluation of the Utica Avenue Study improvements packages. Thus, the Utica Avenue Study has assumed that CBTC is part of the No Build condition.

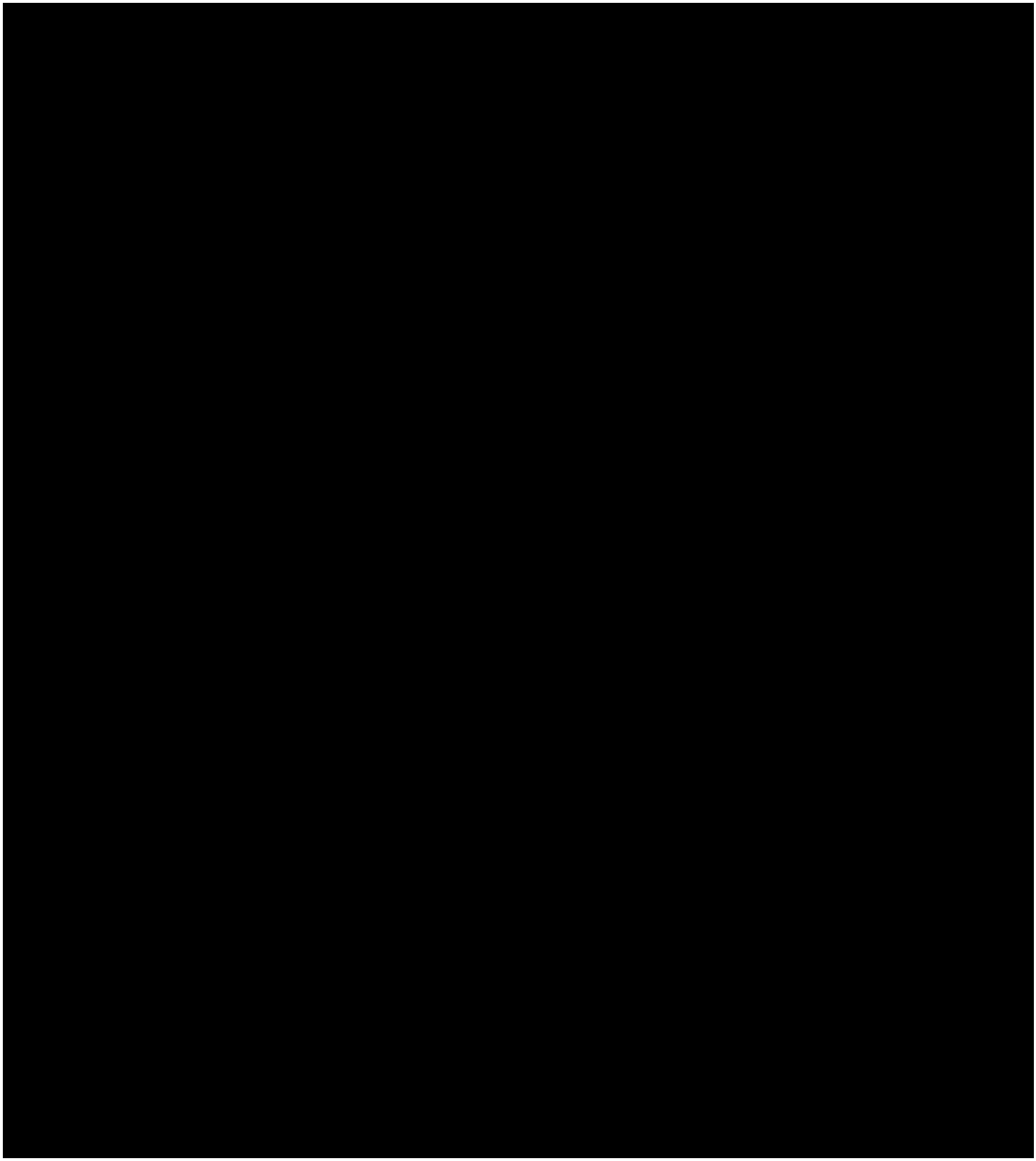
5 Proposed Improvements

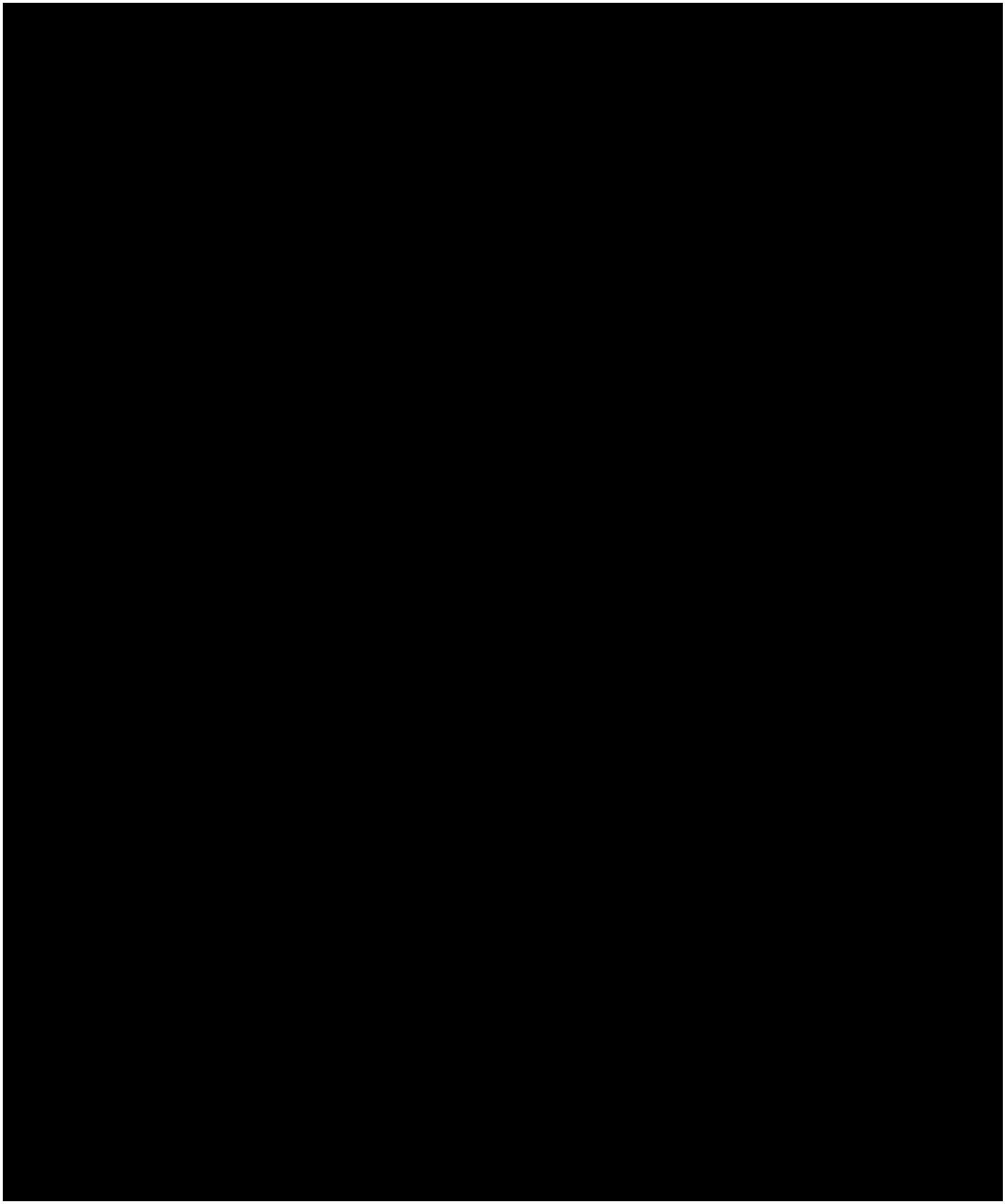


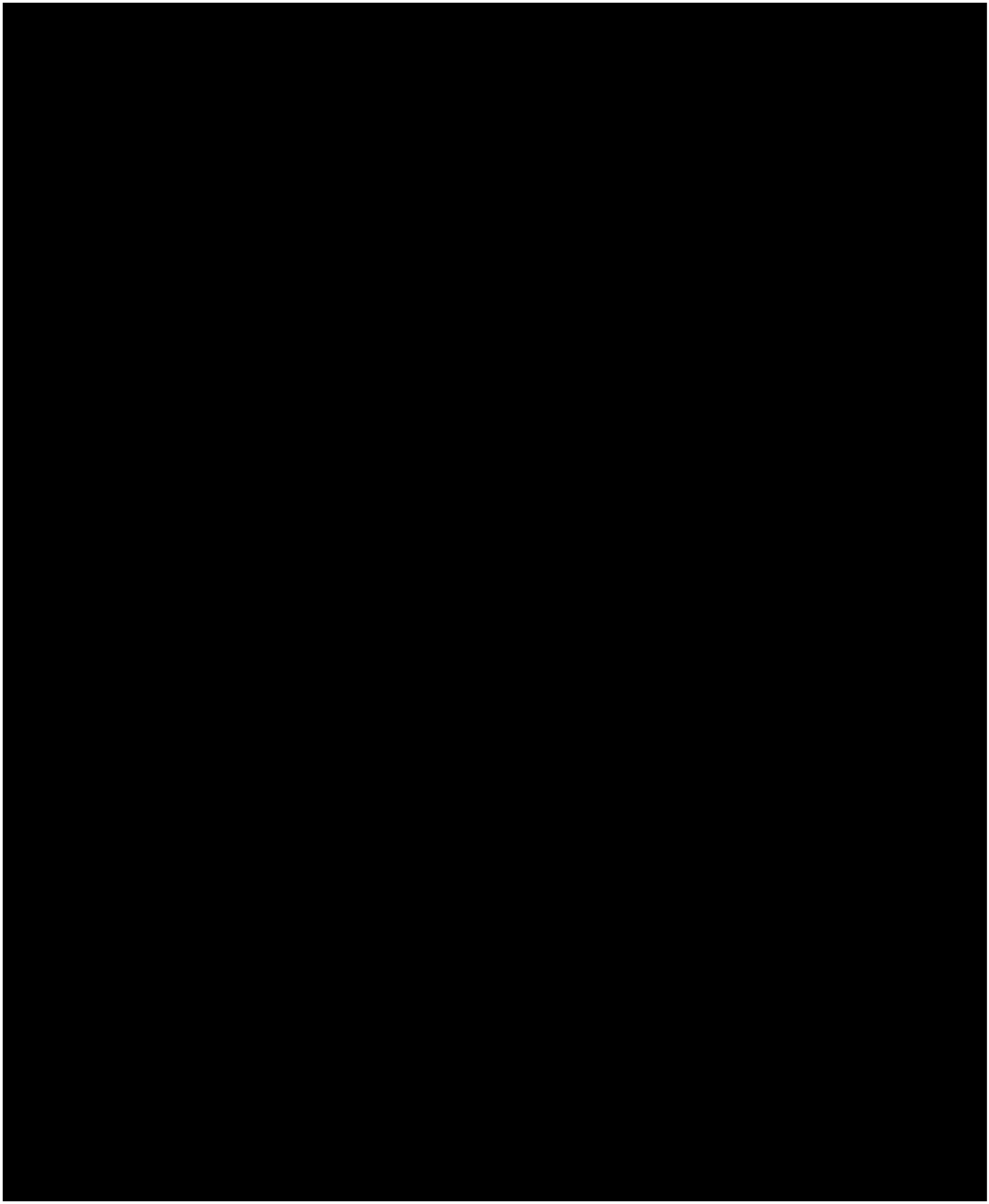


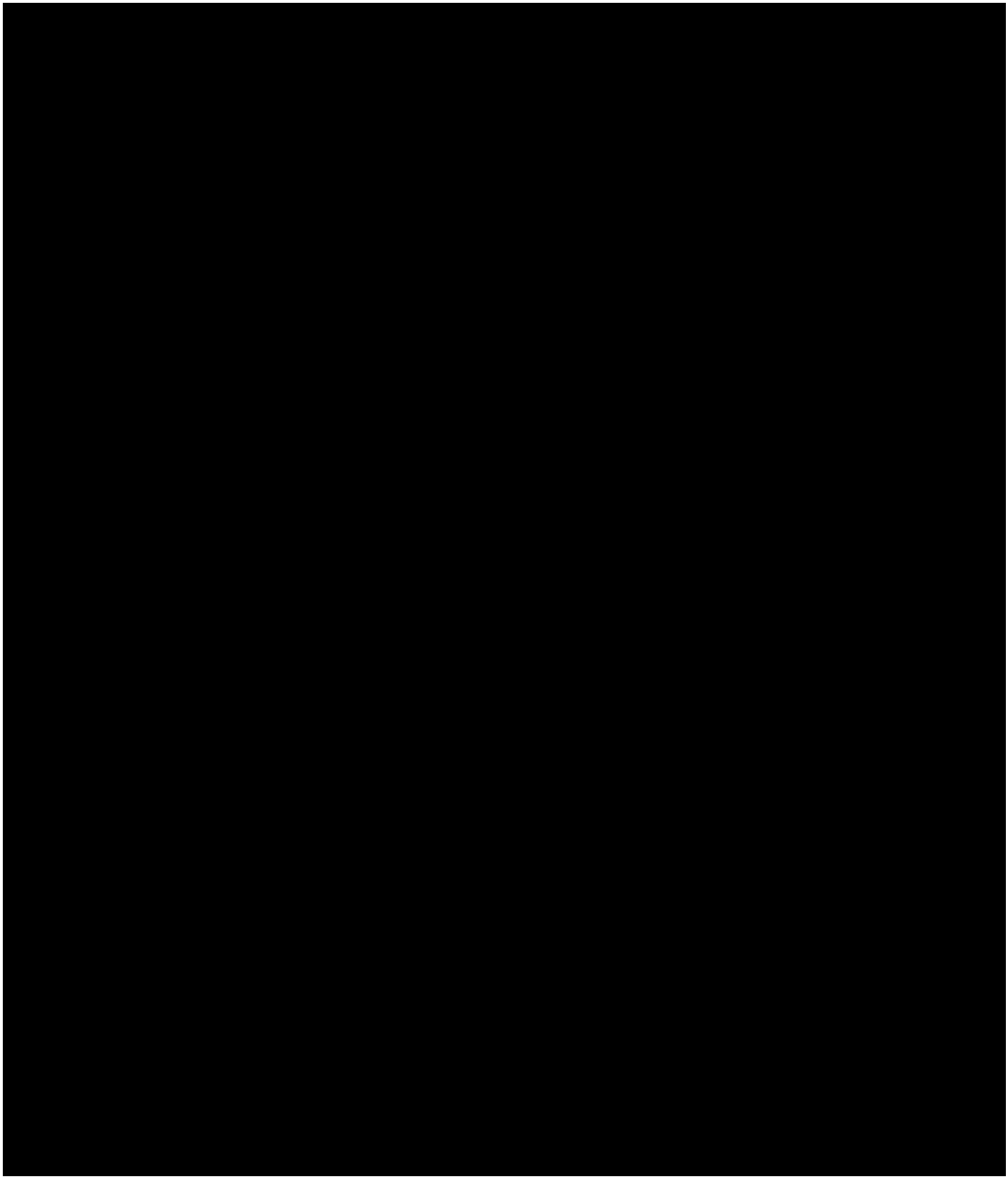


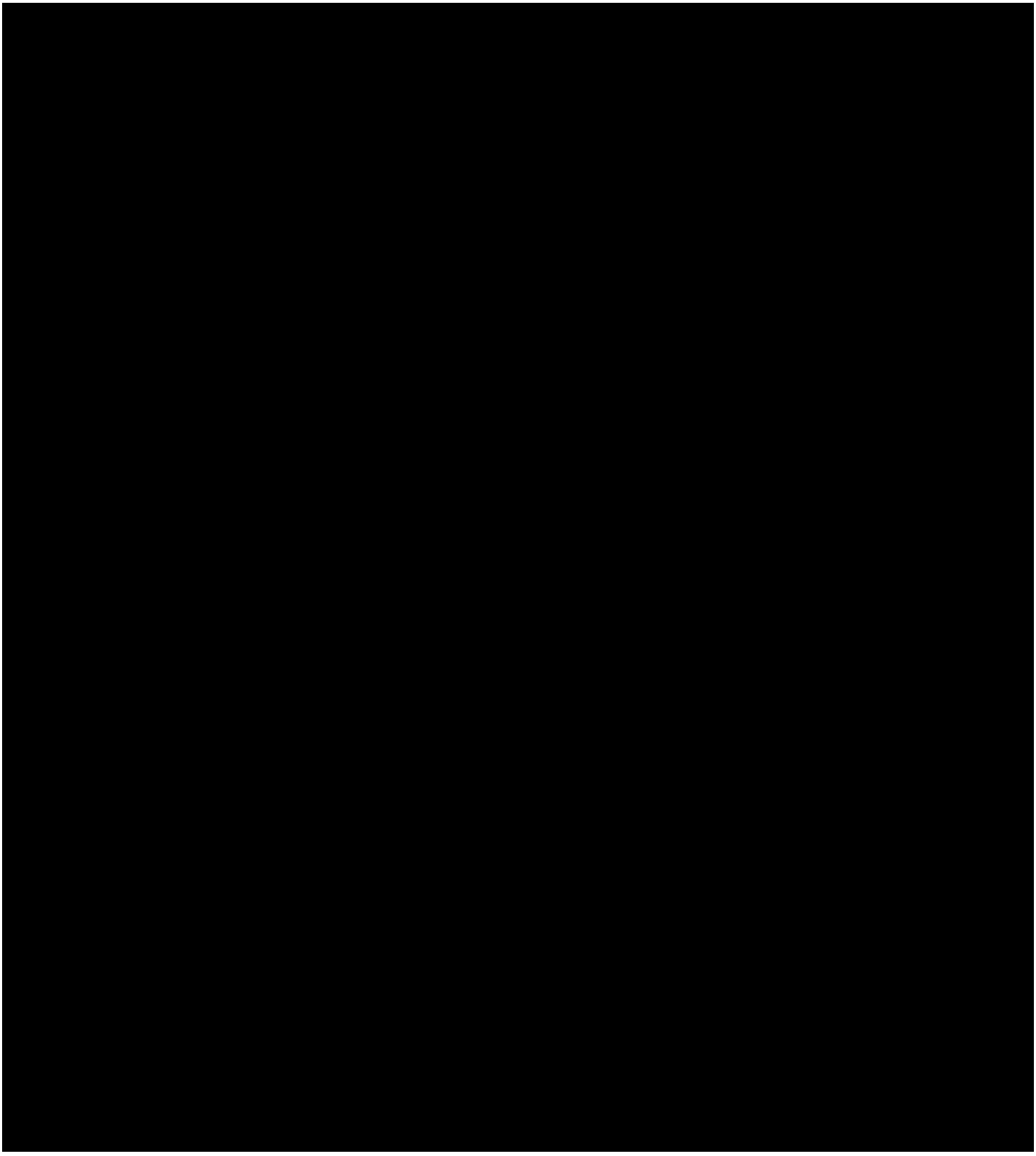


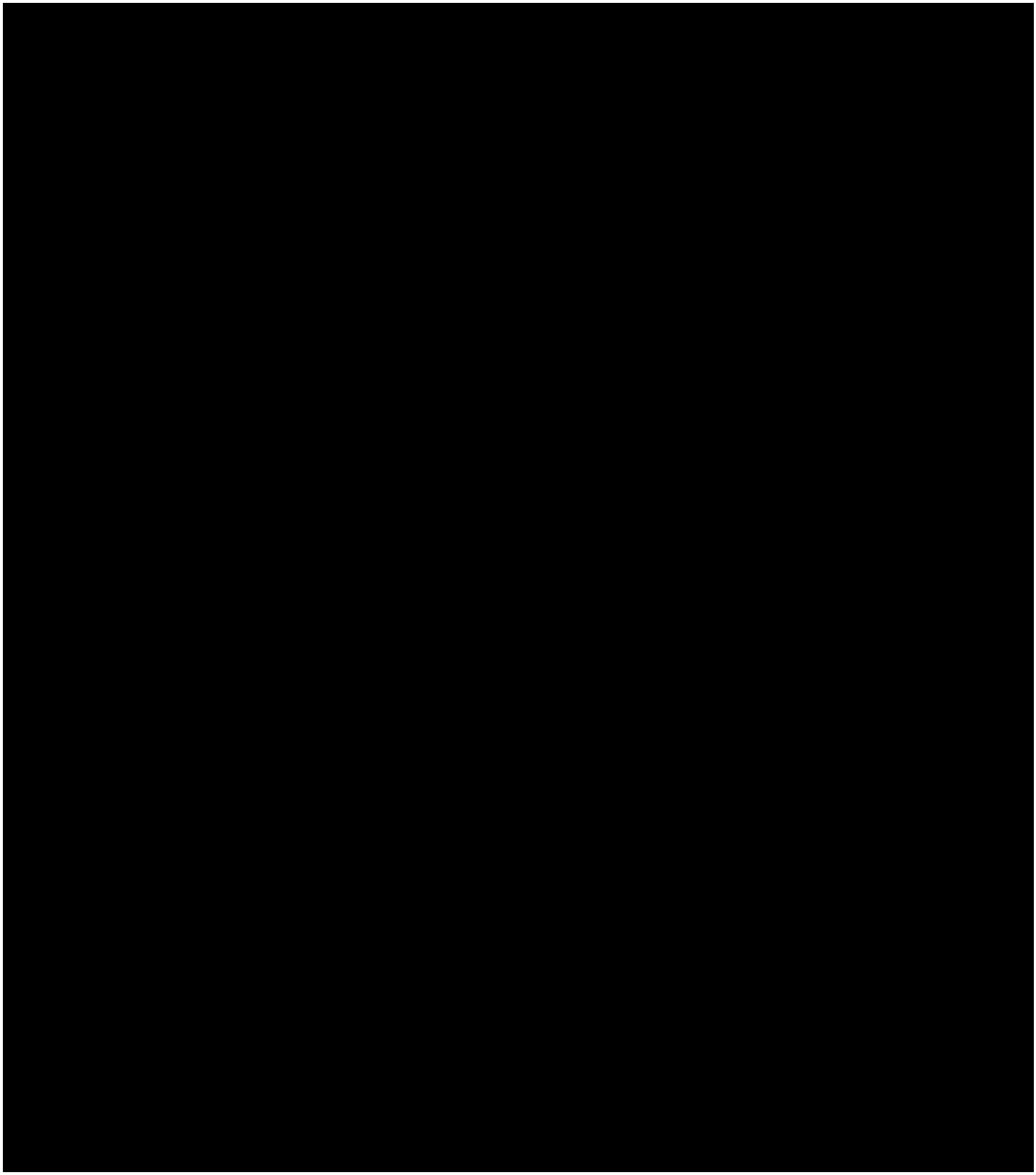


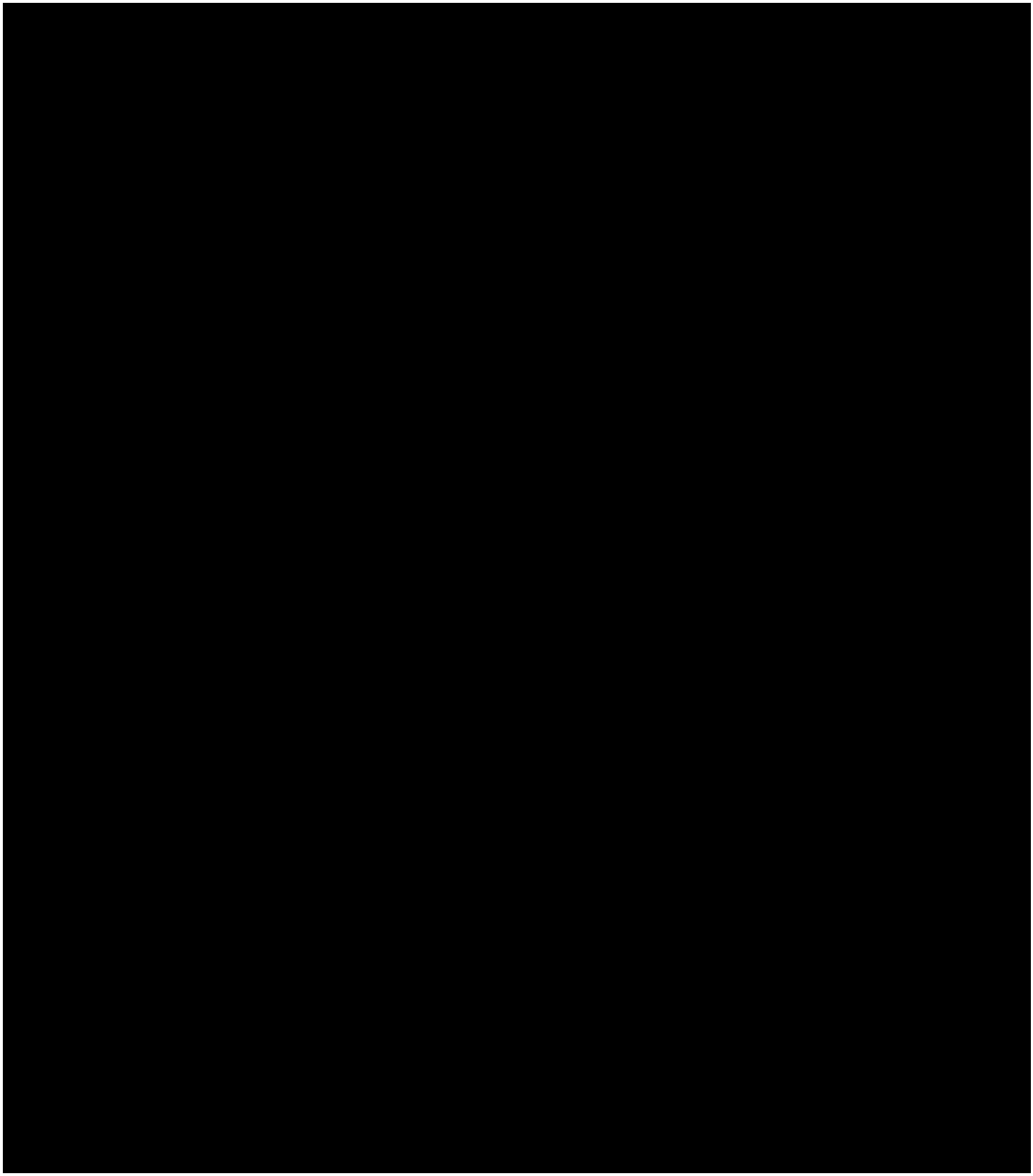


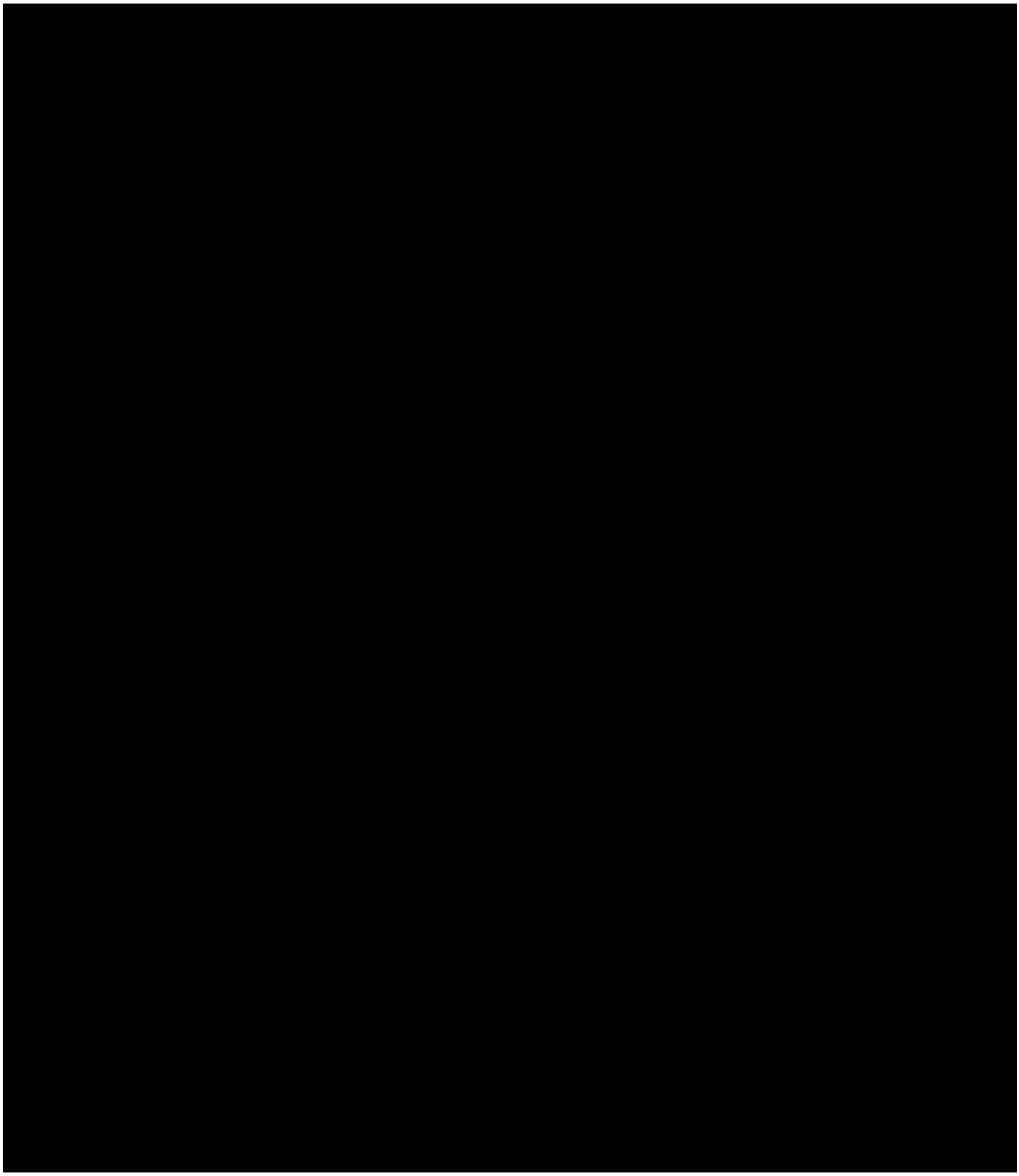


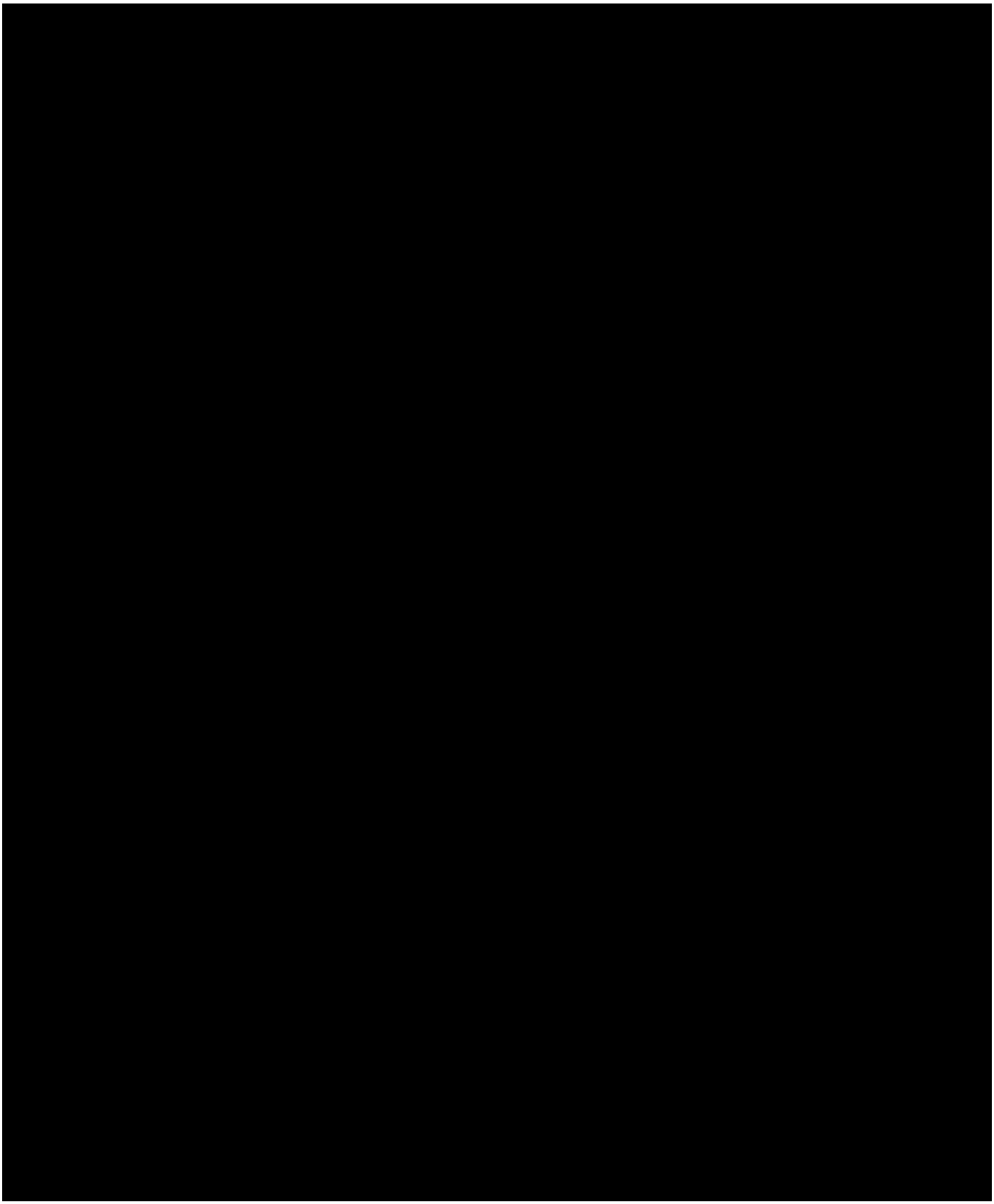


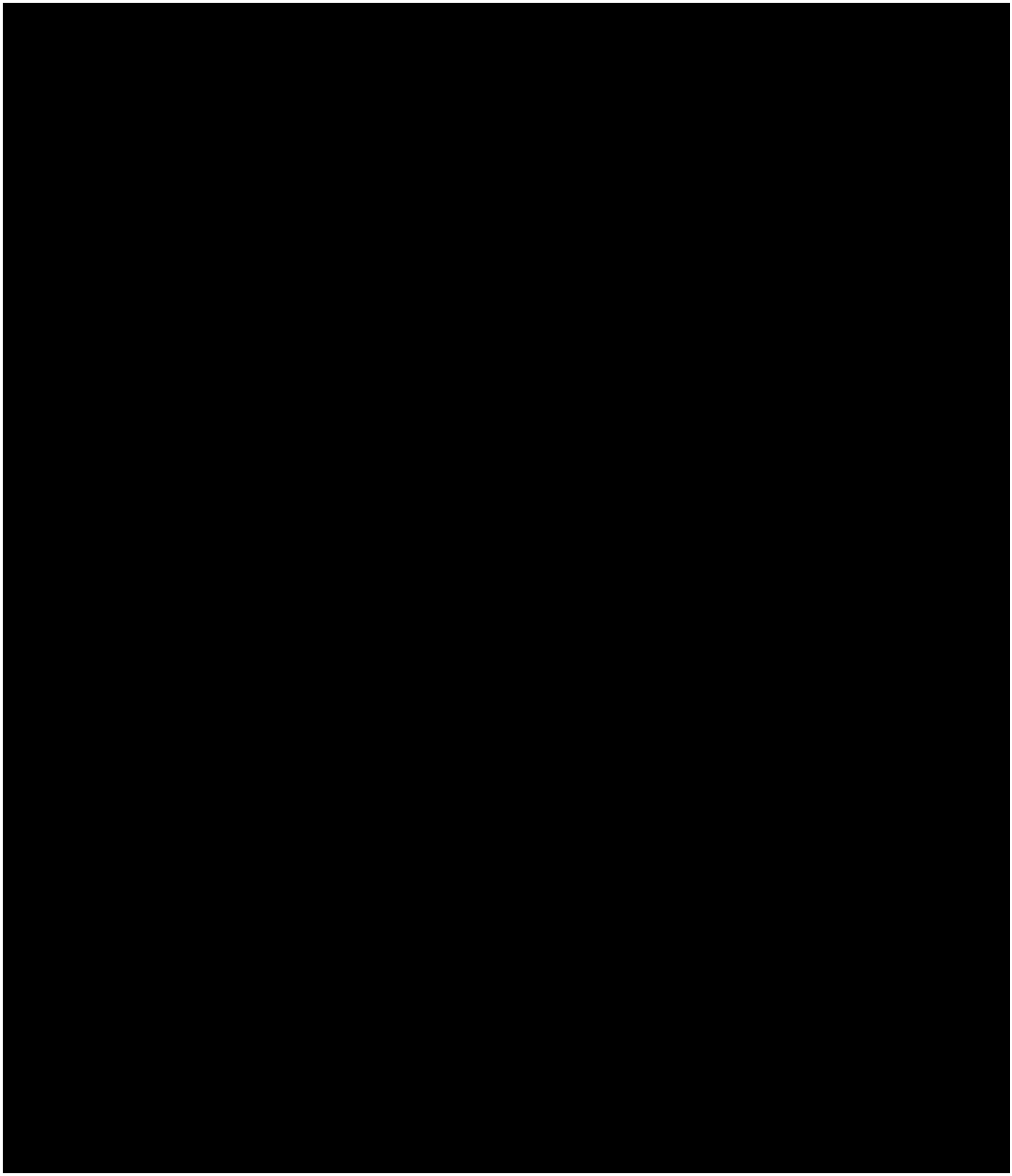


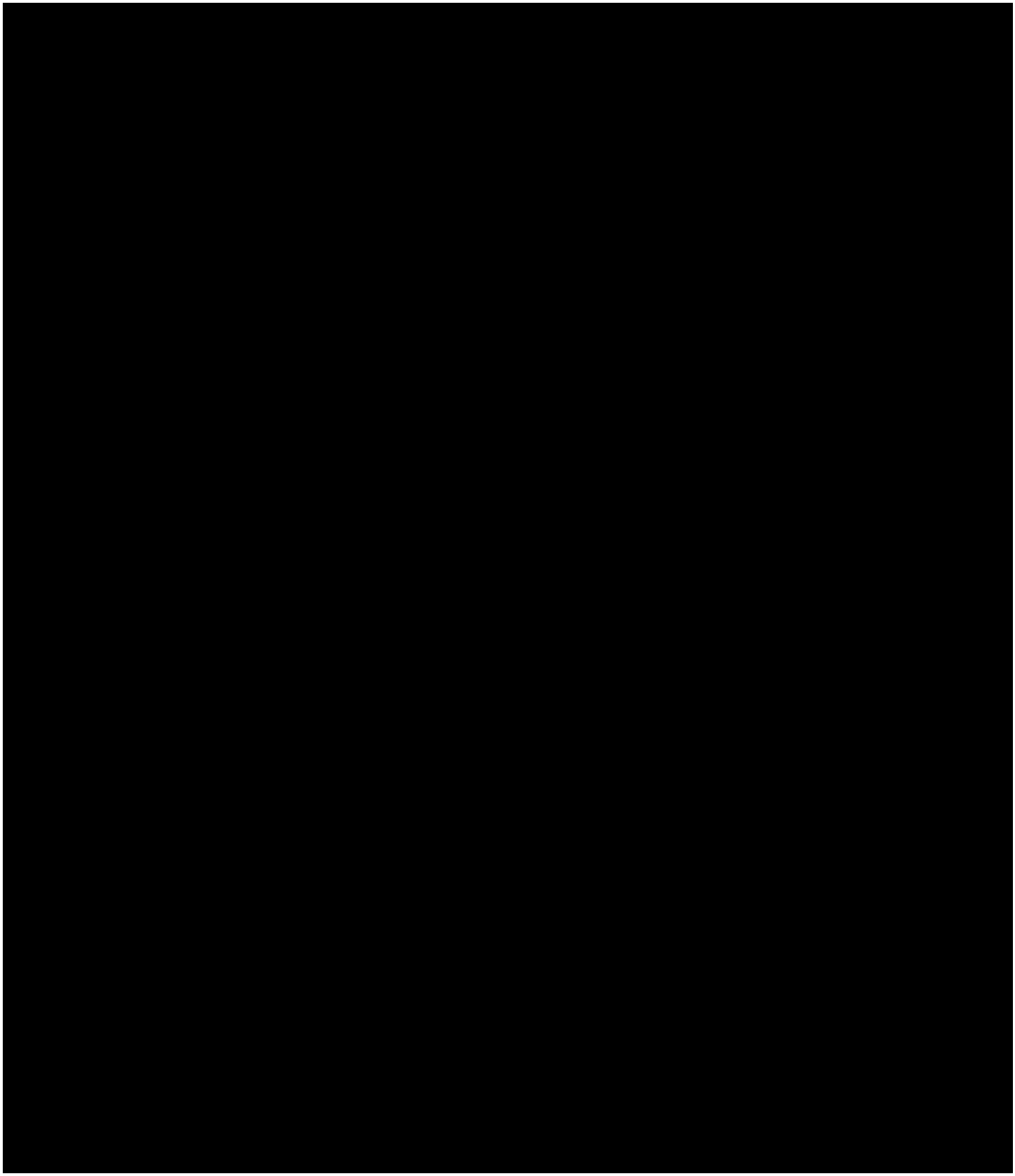


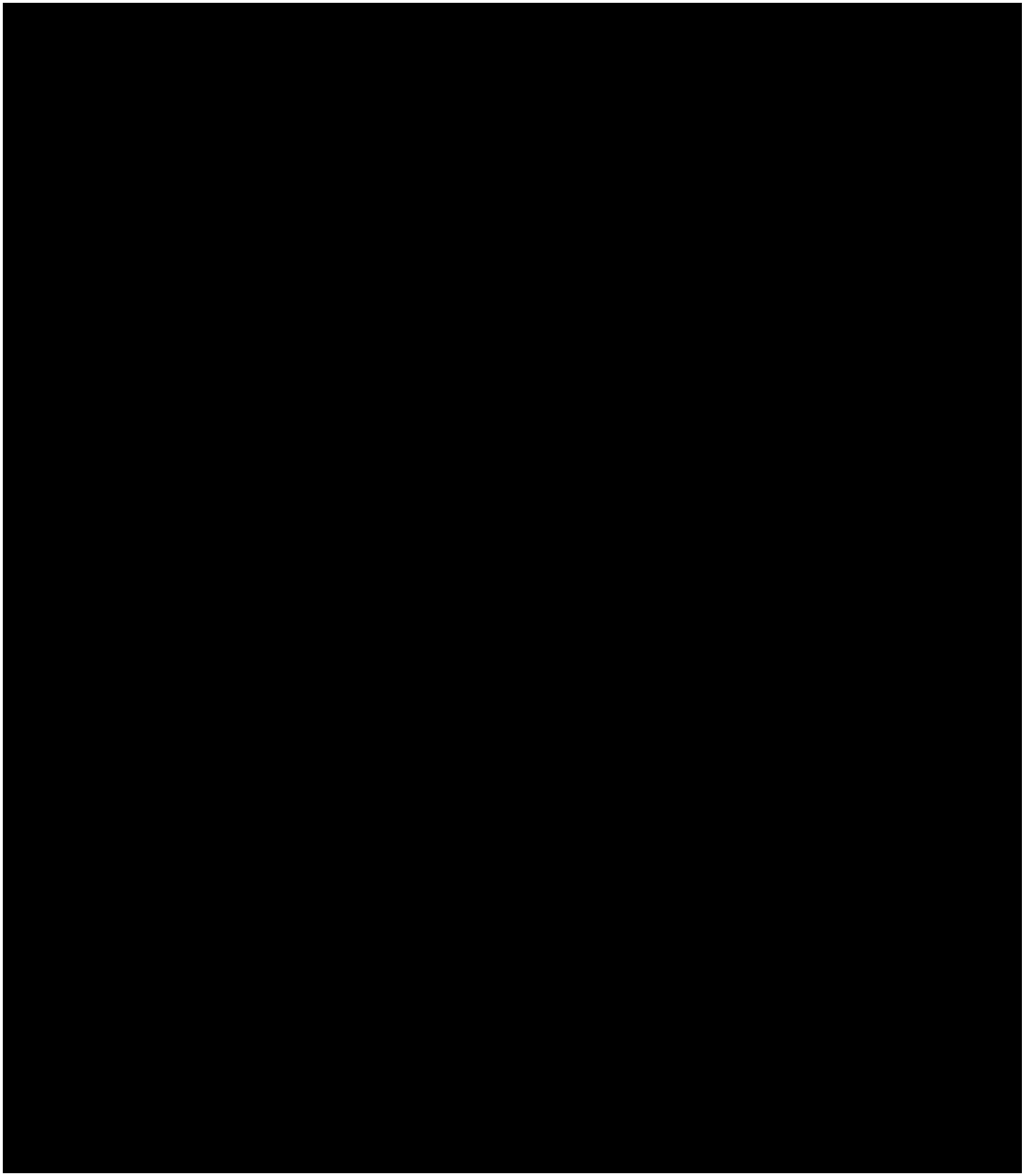


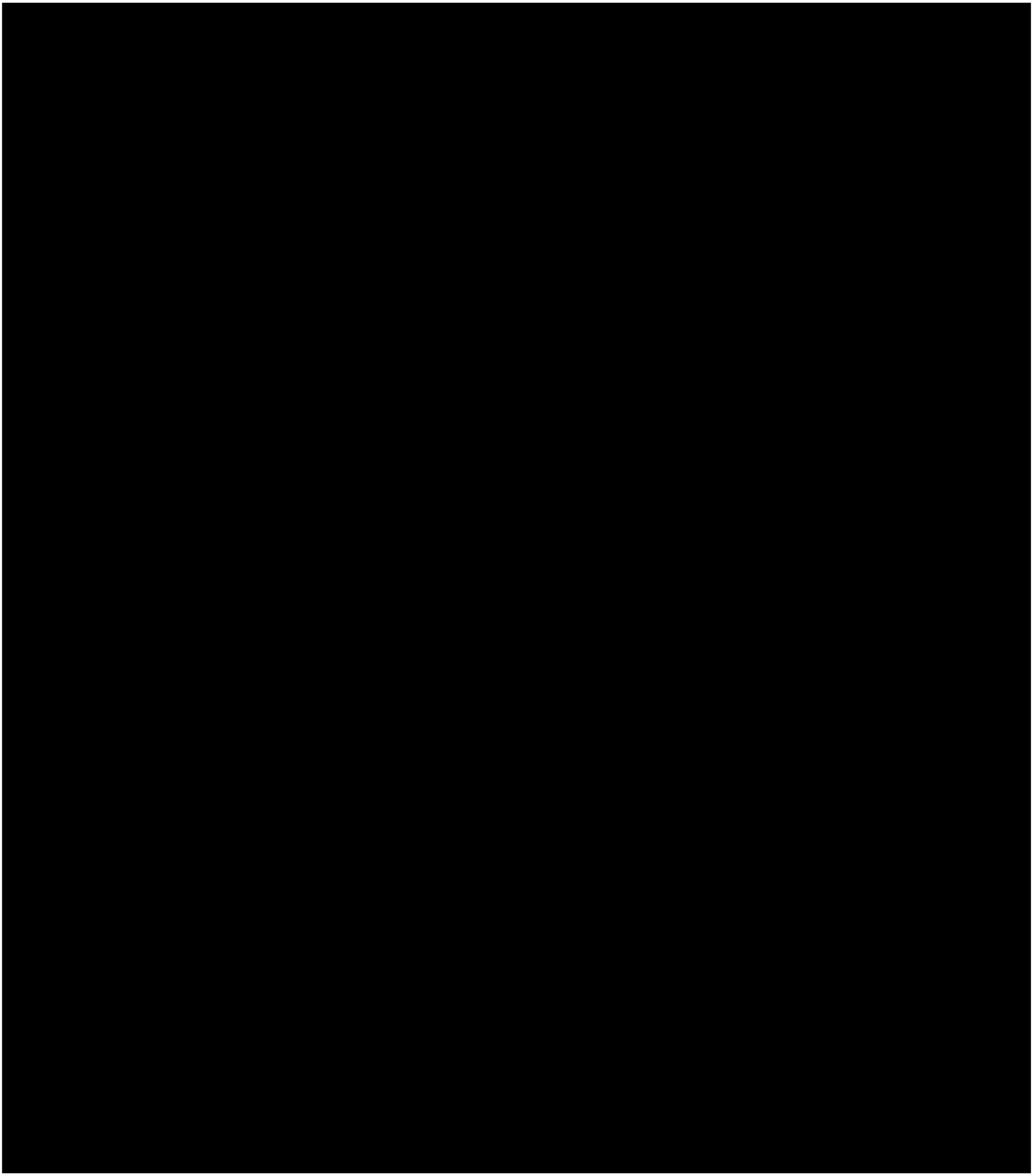


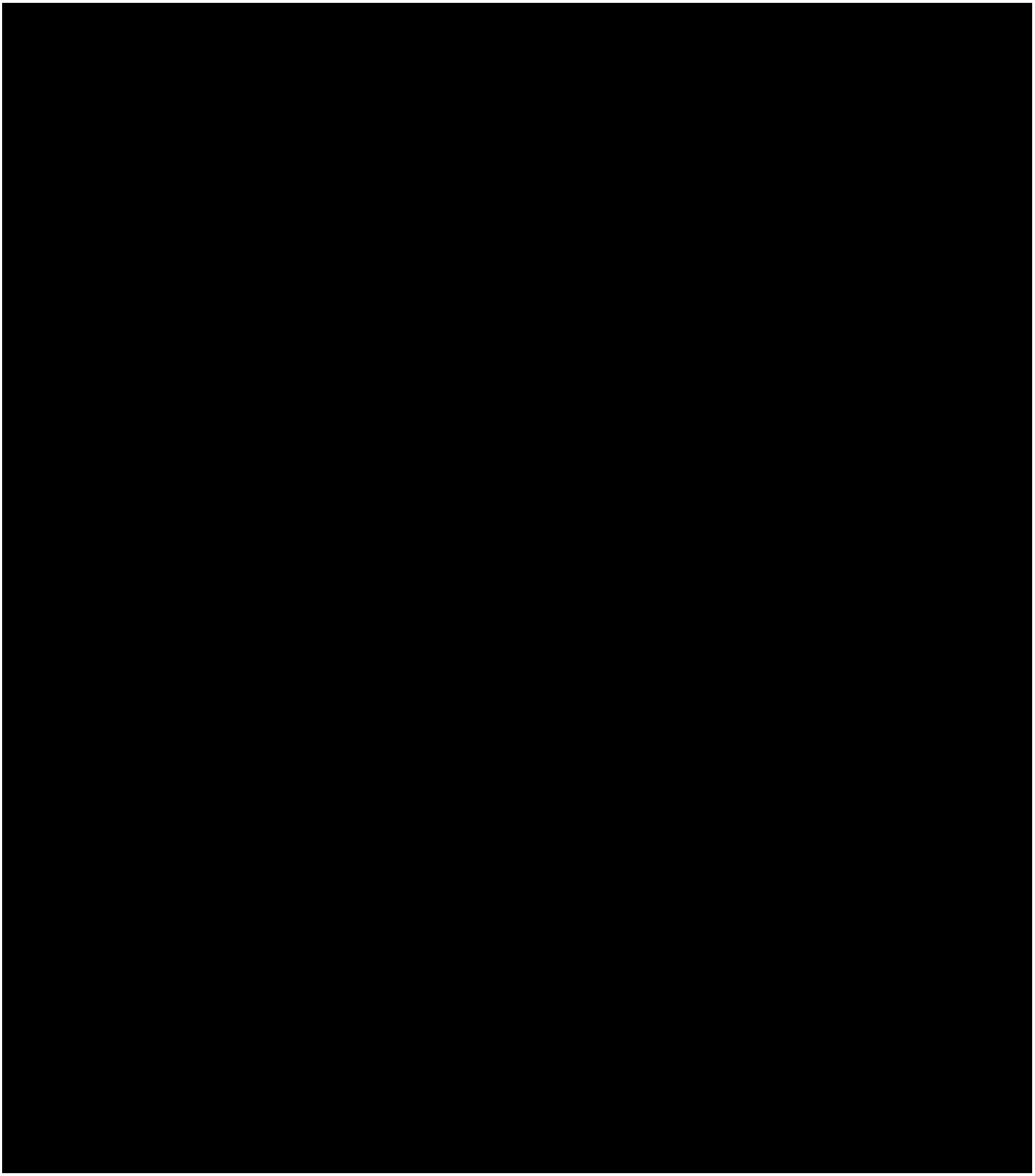


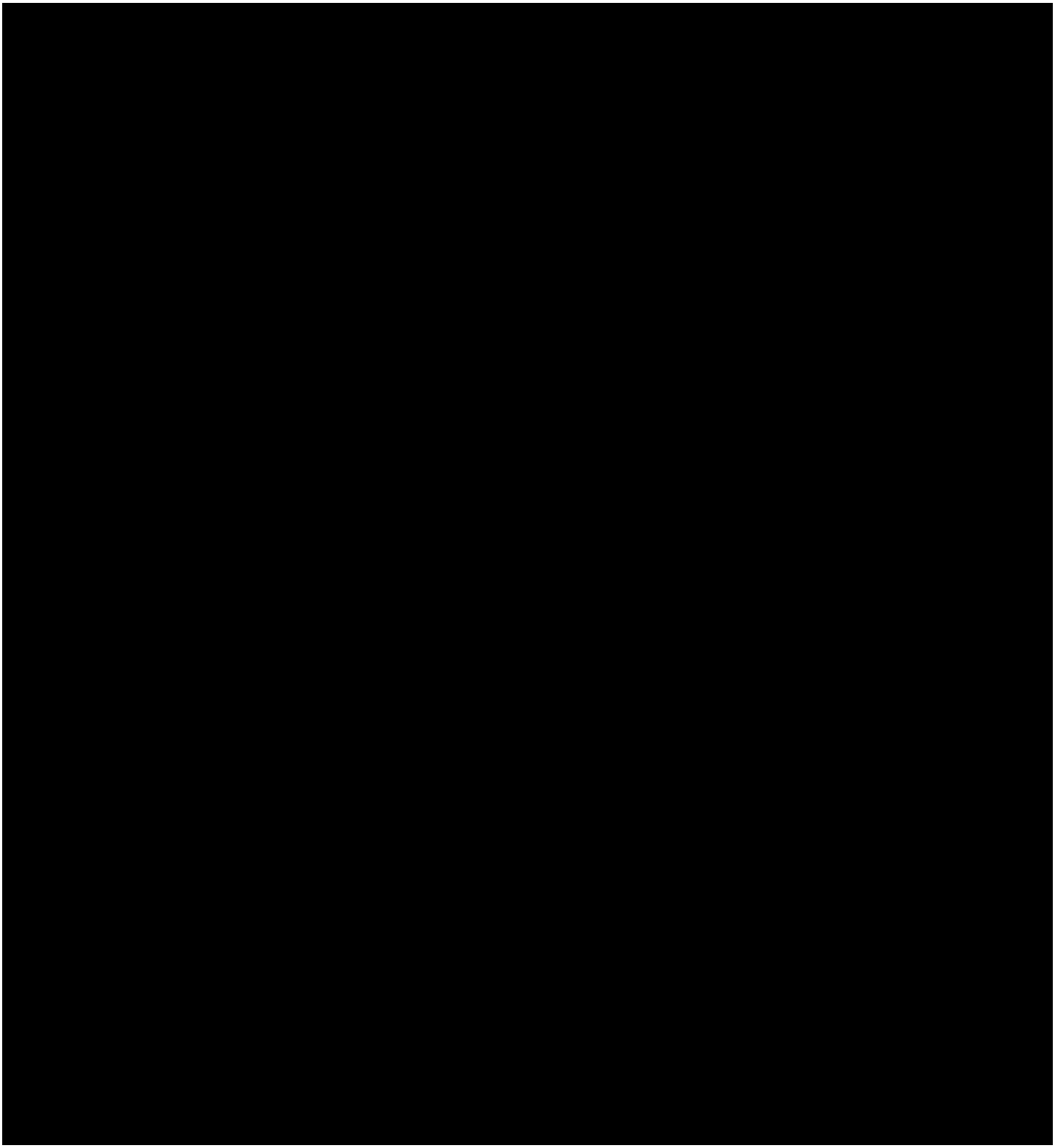


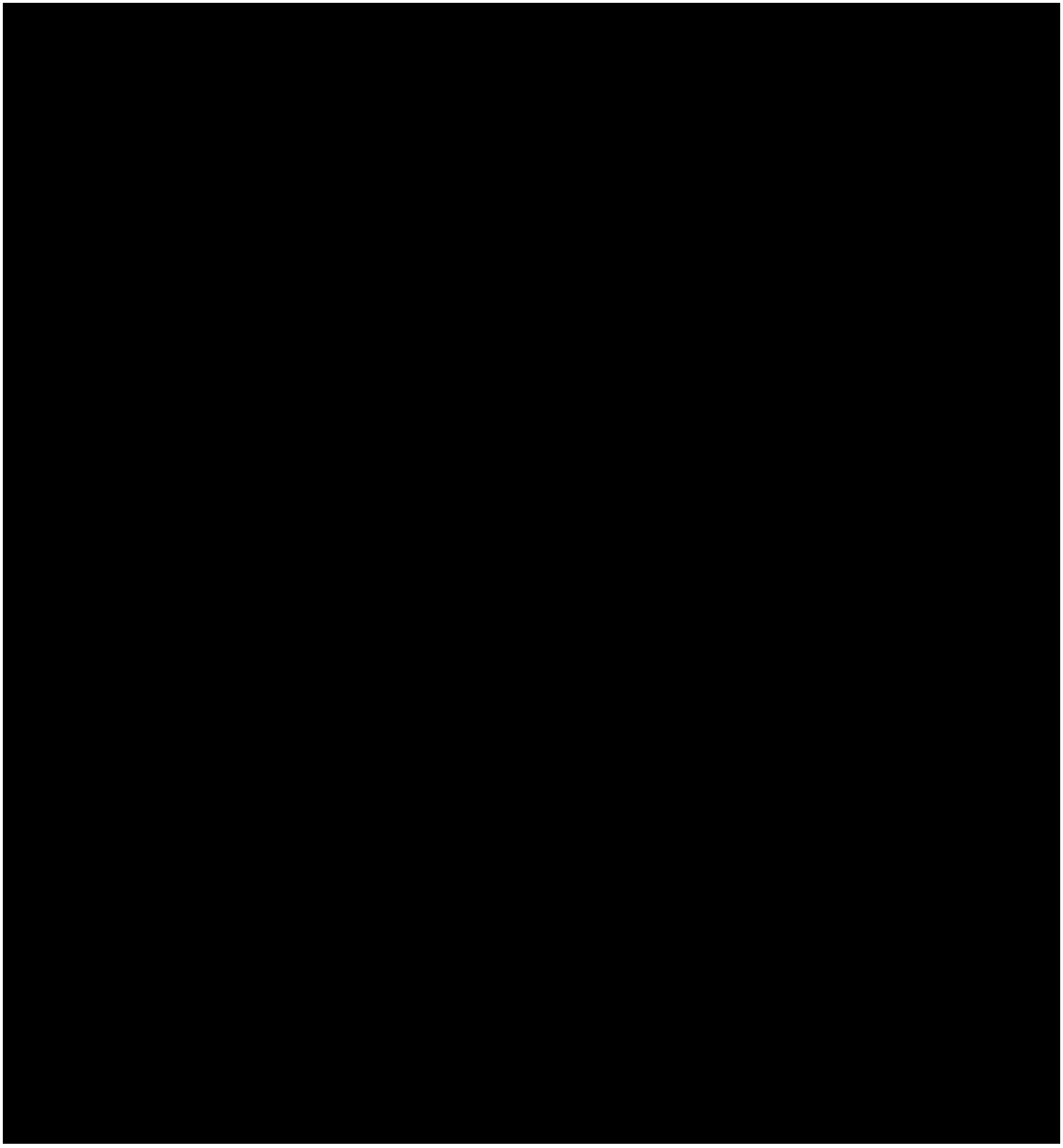


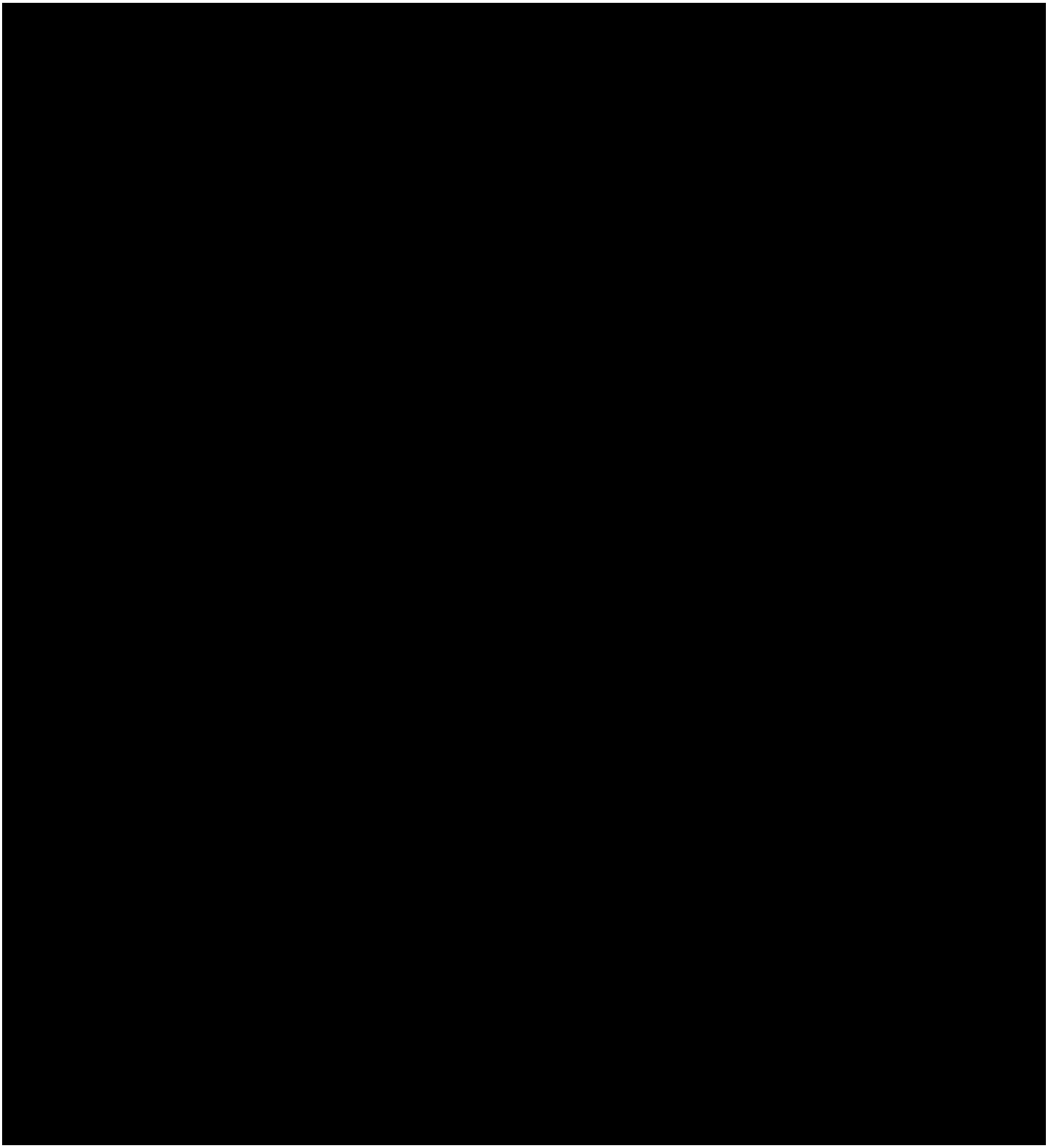


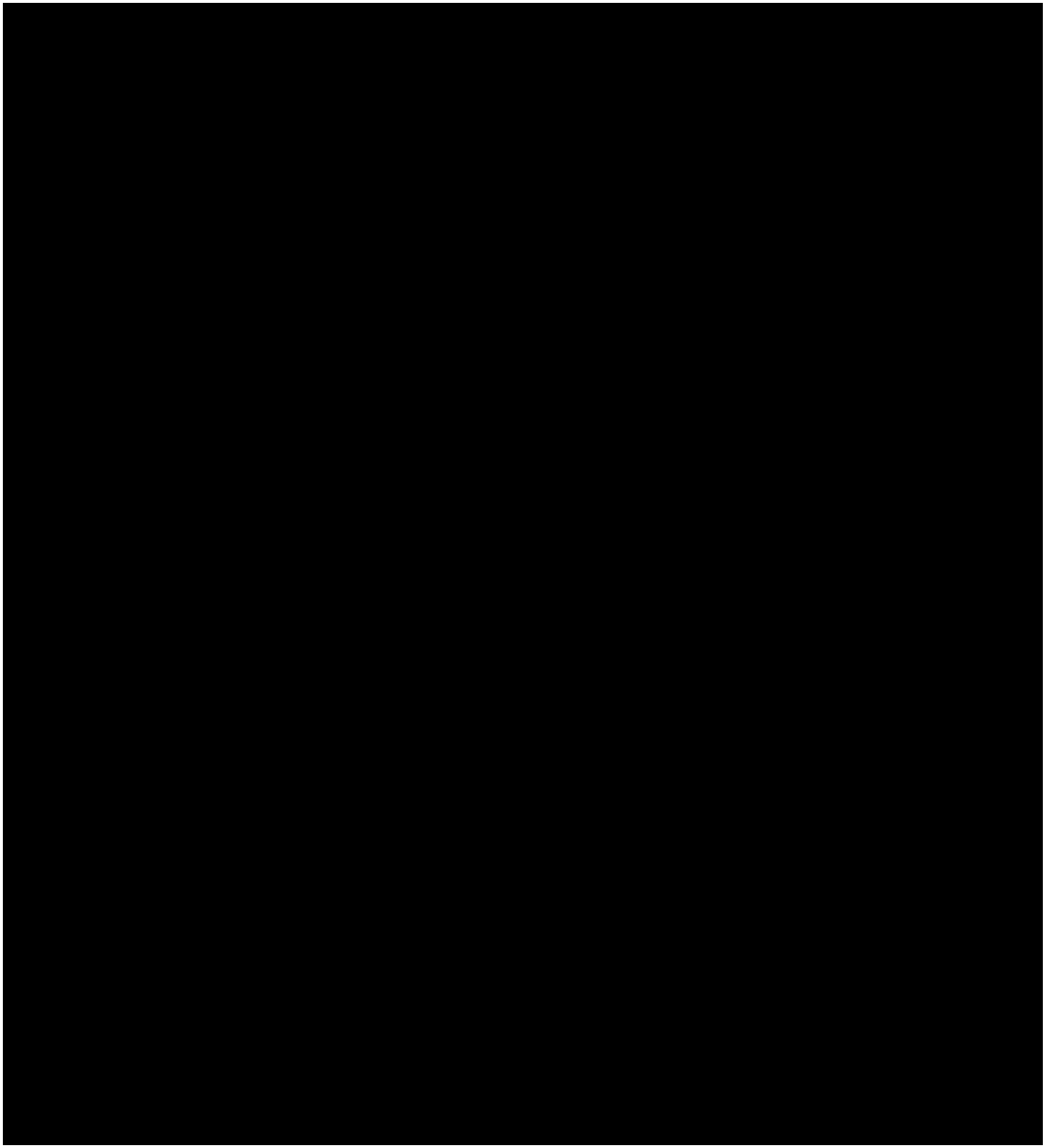


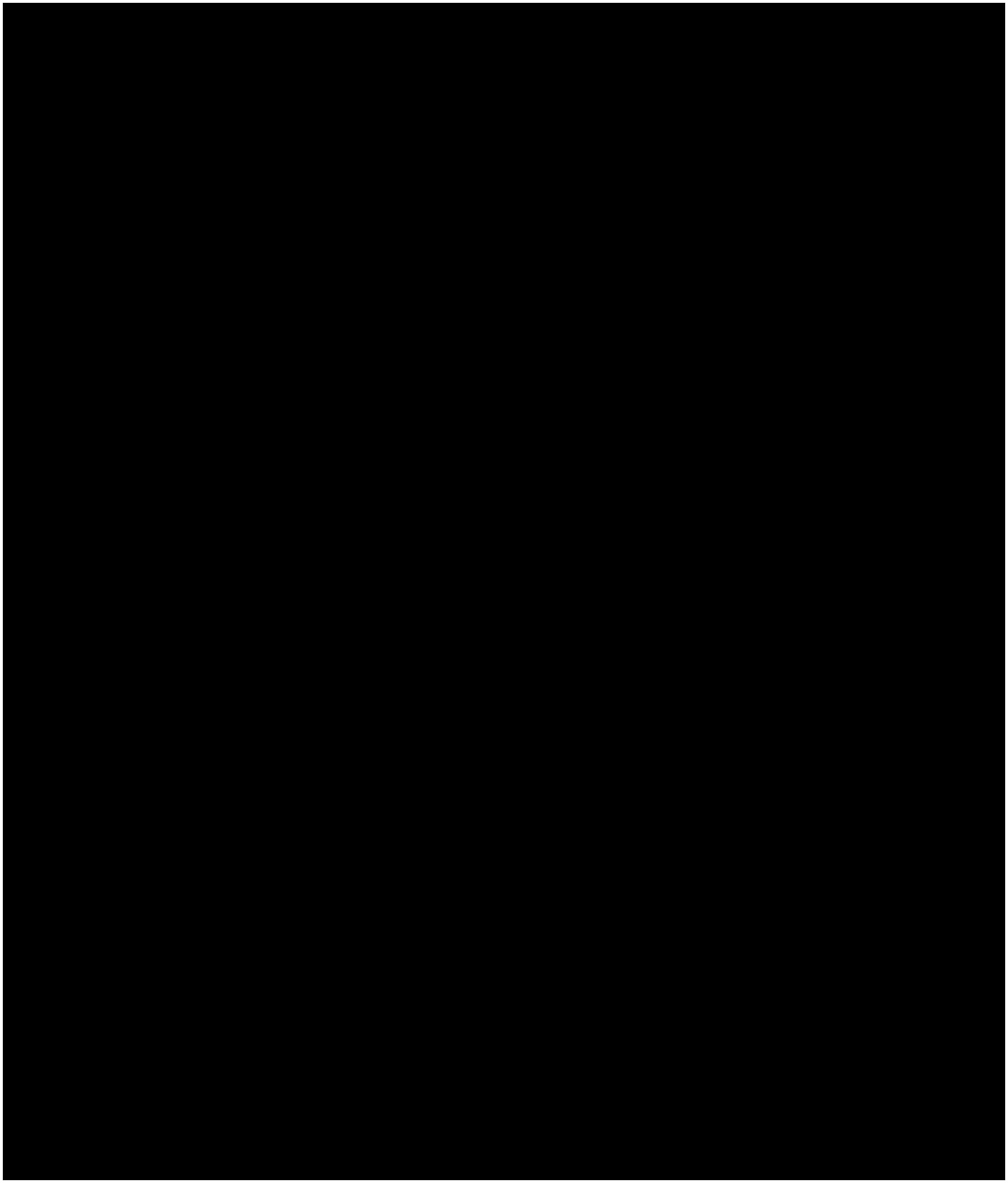


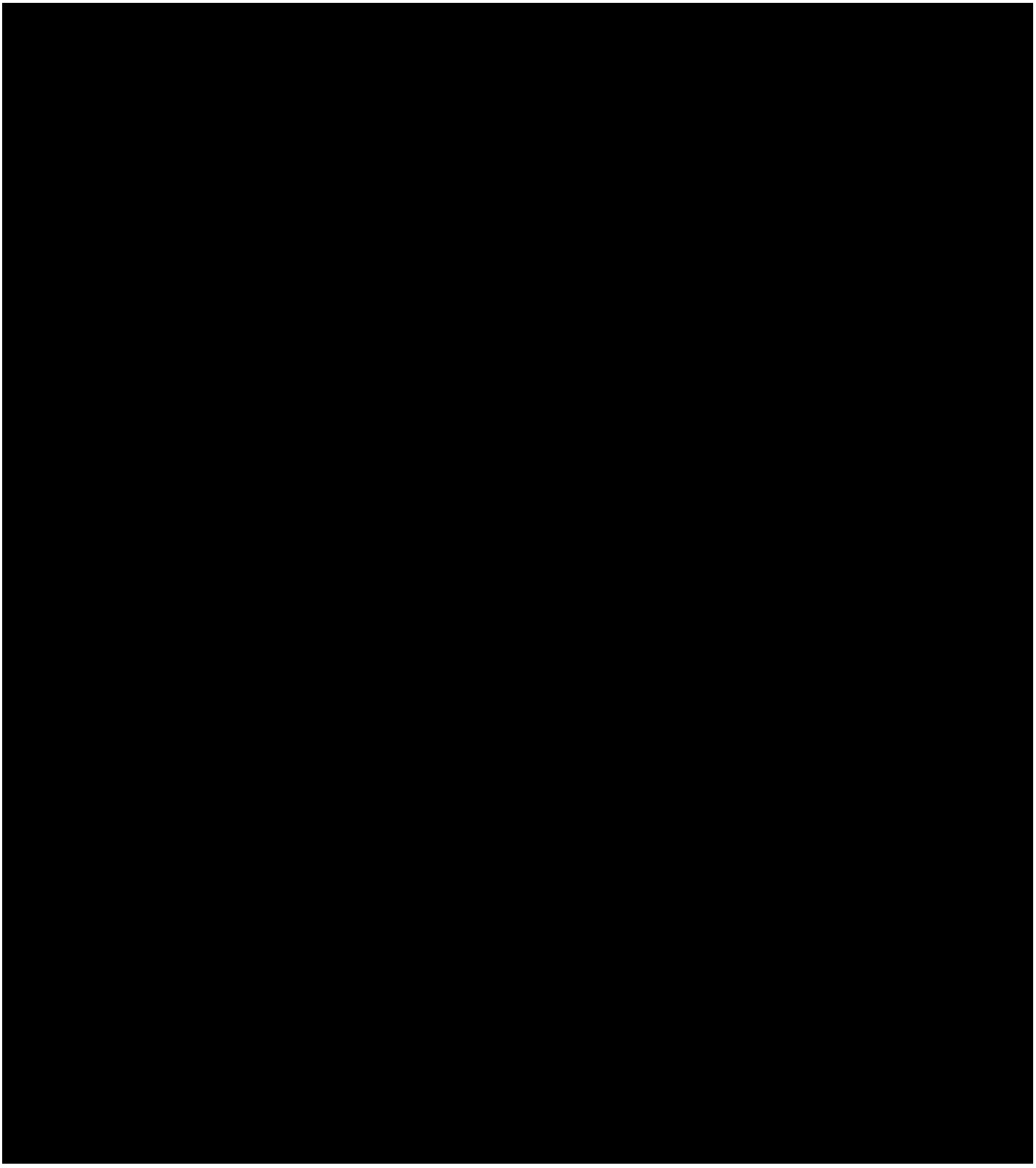


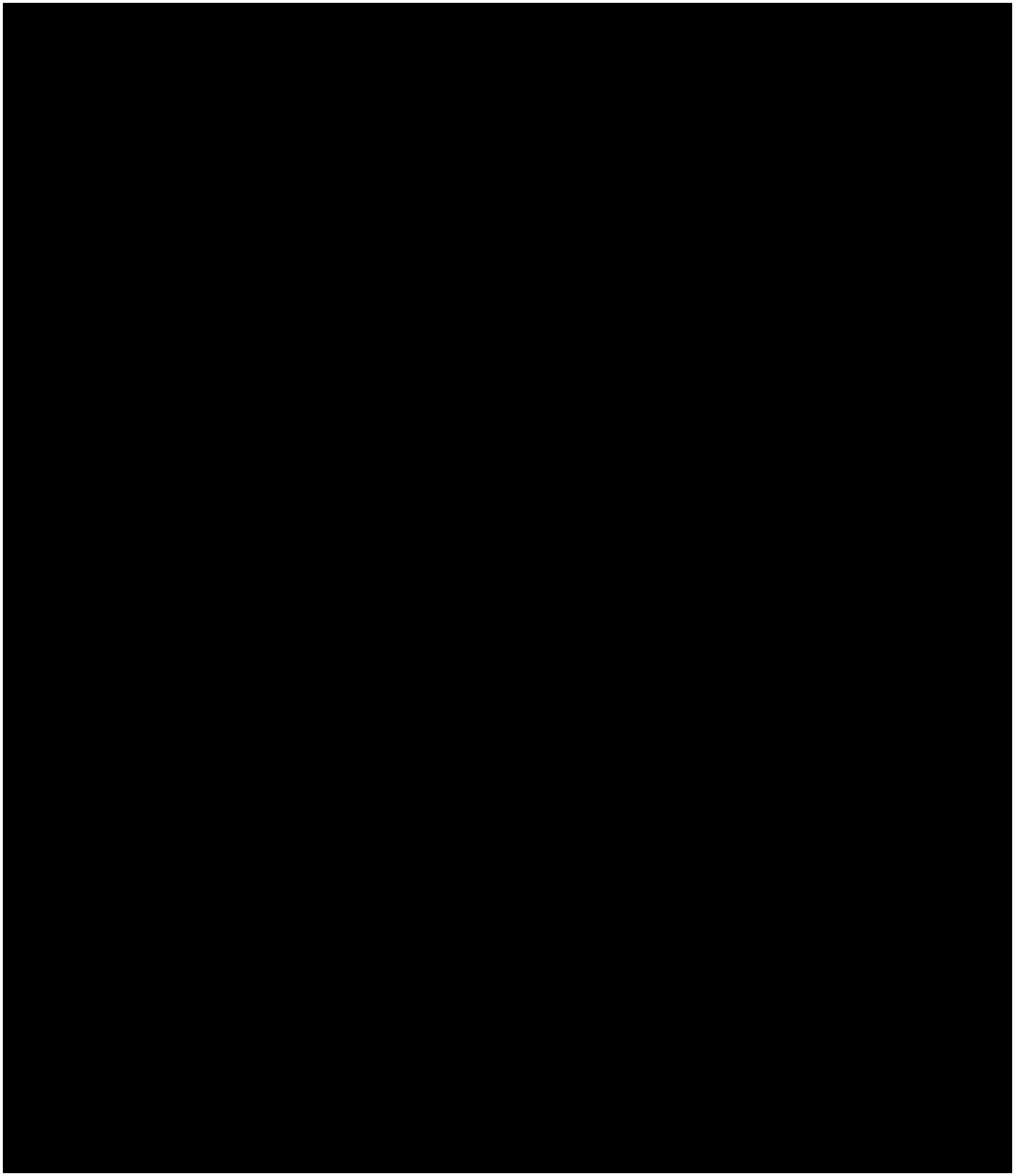


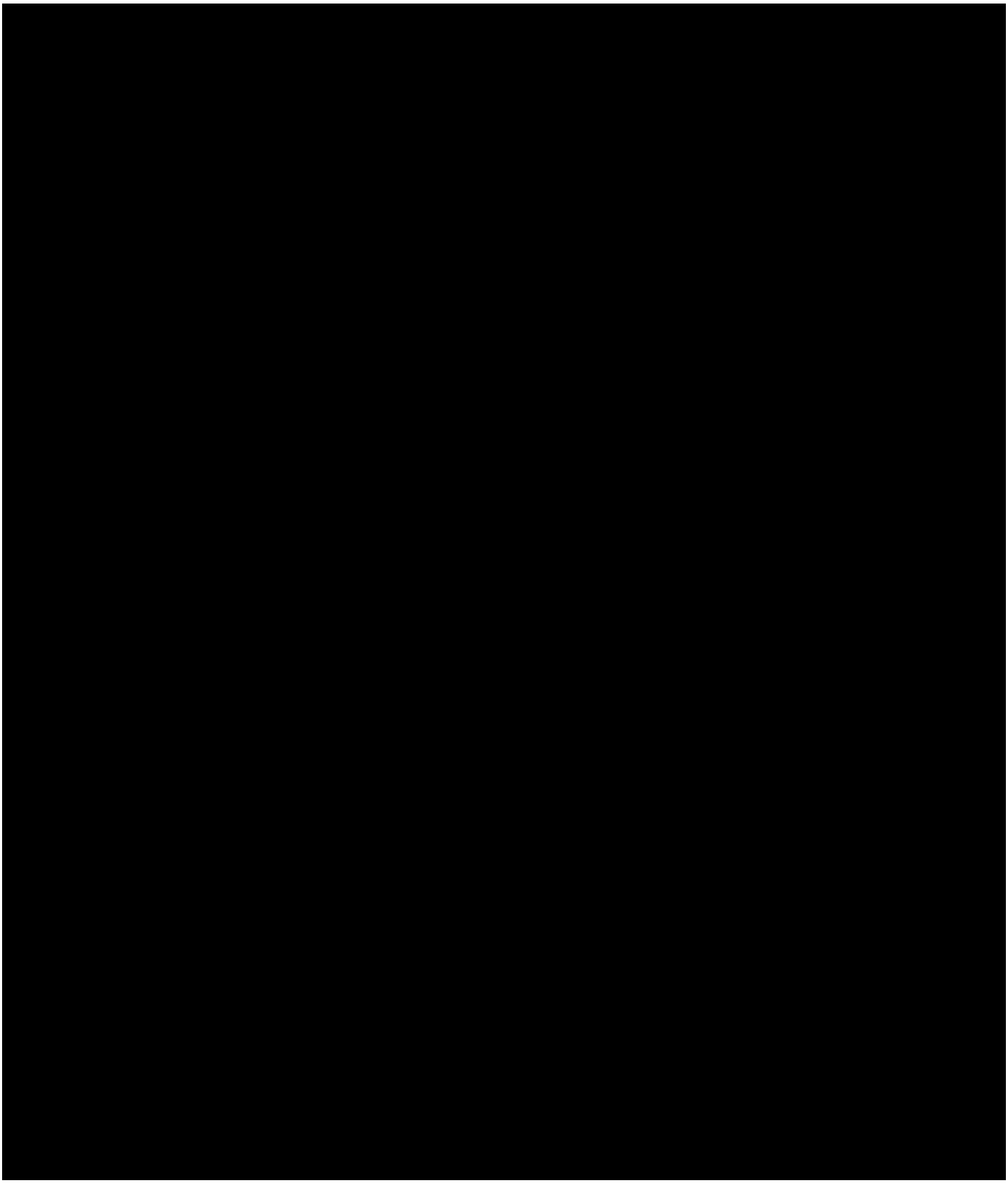


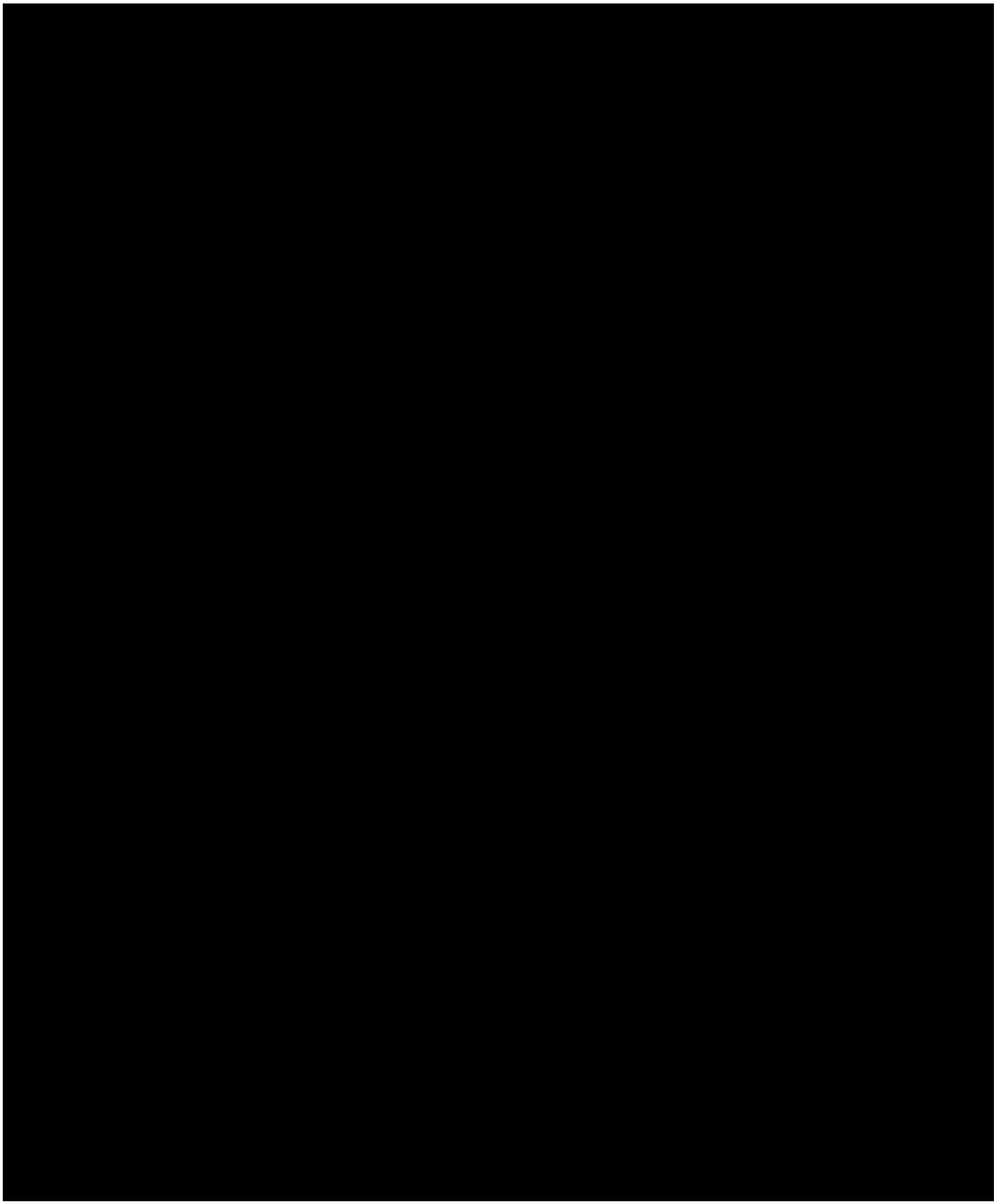


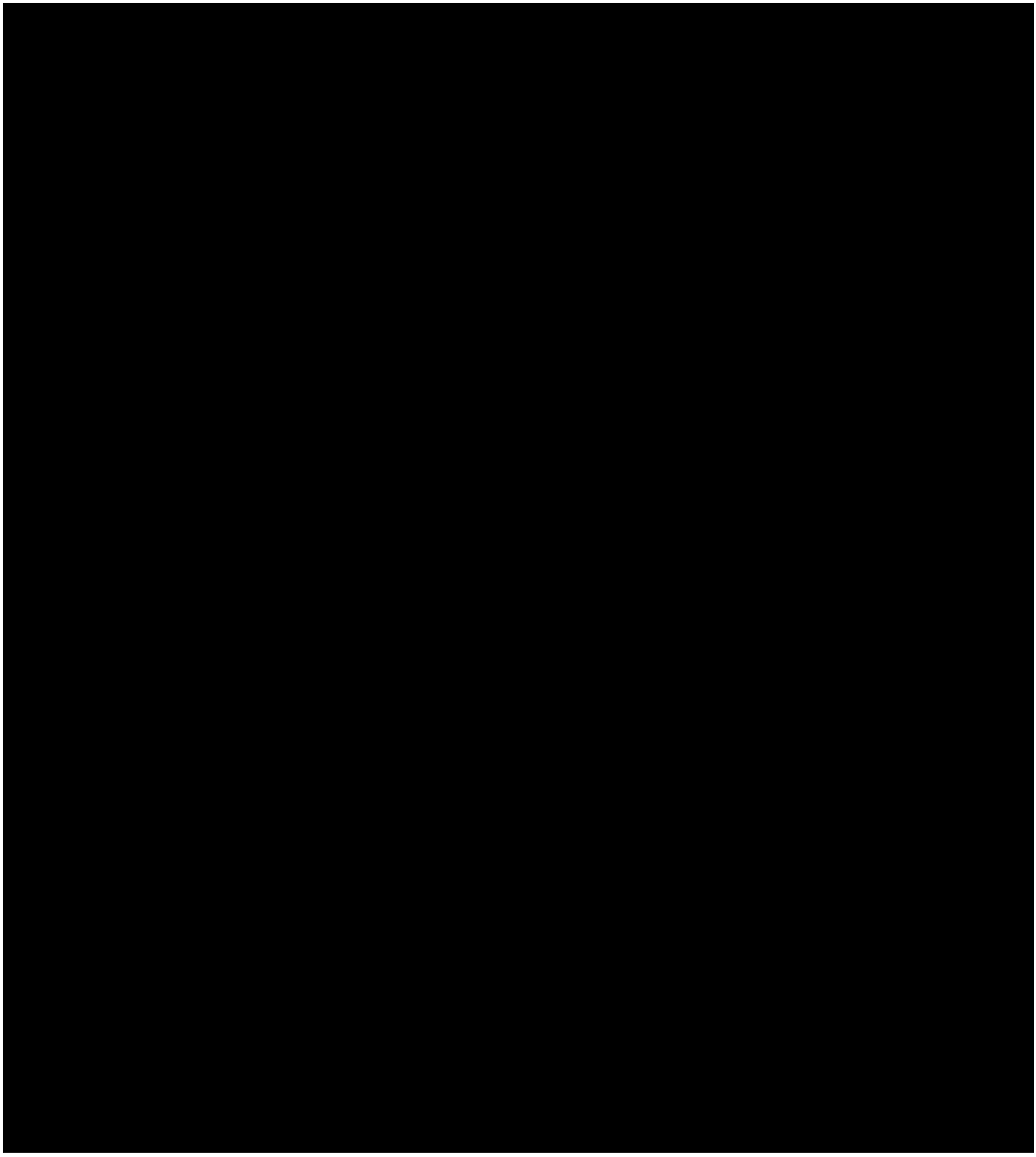


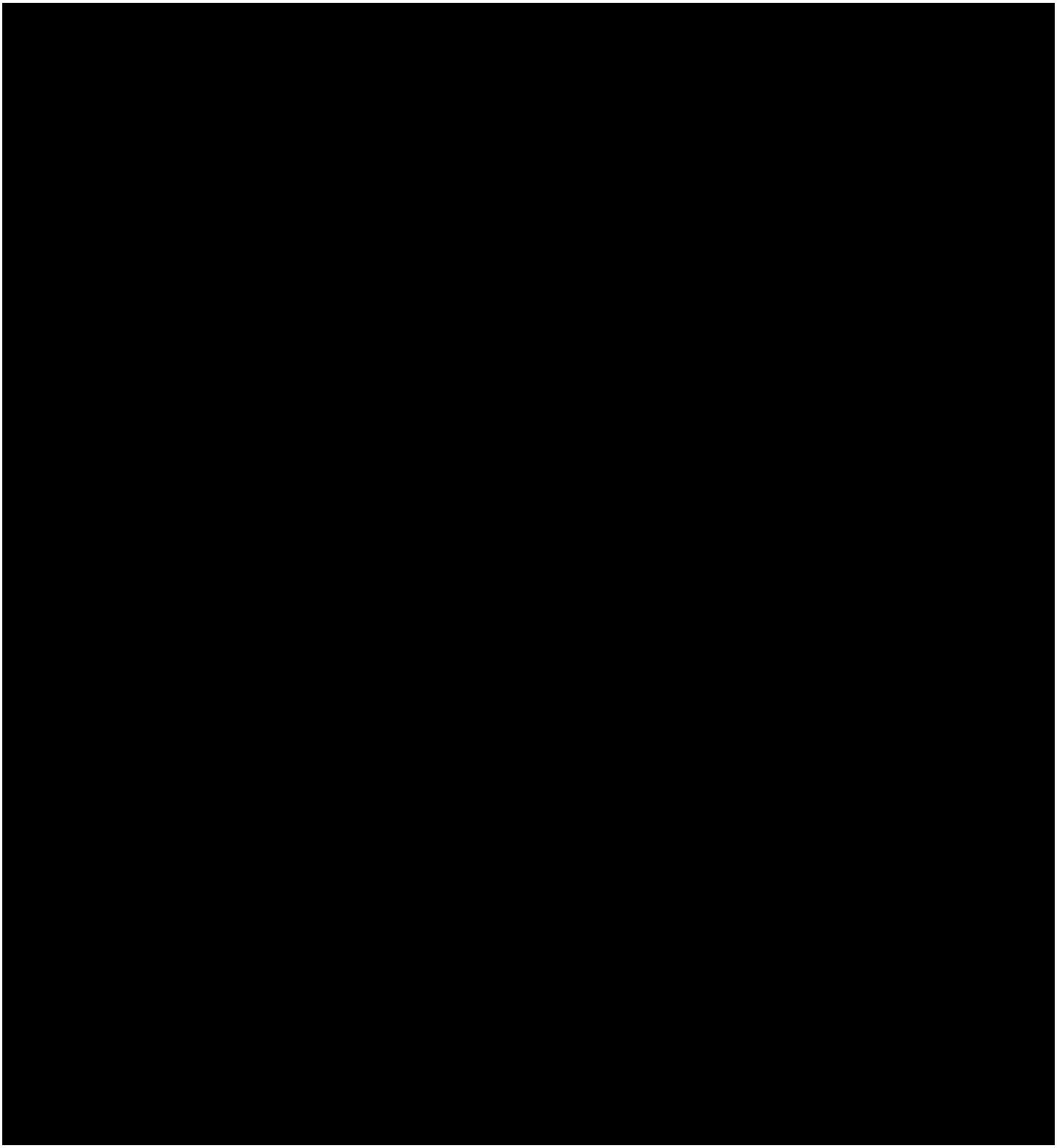


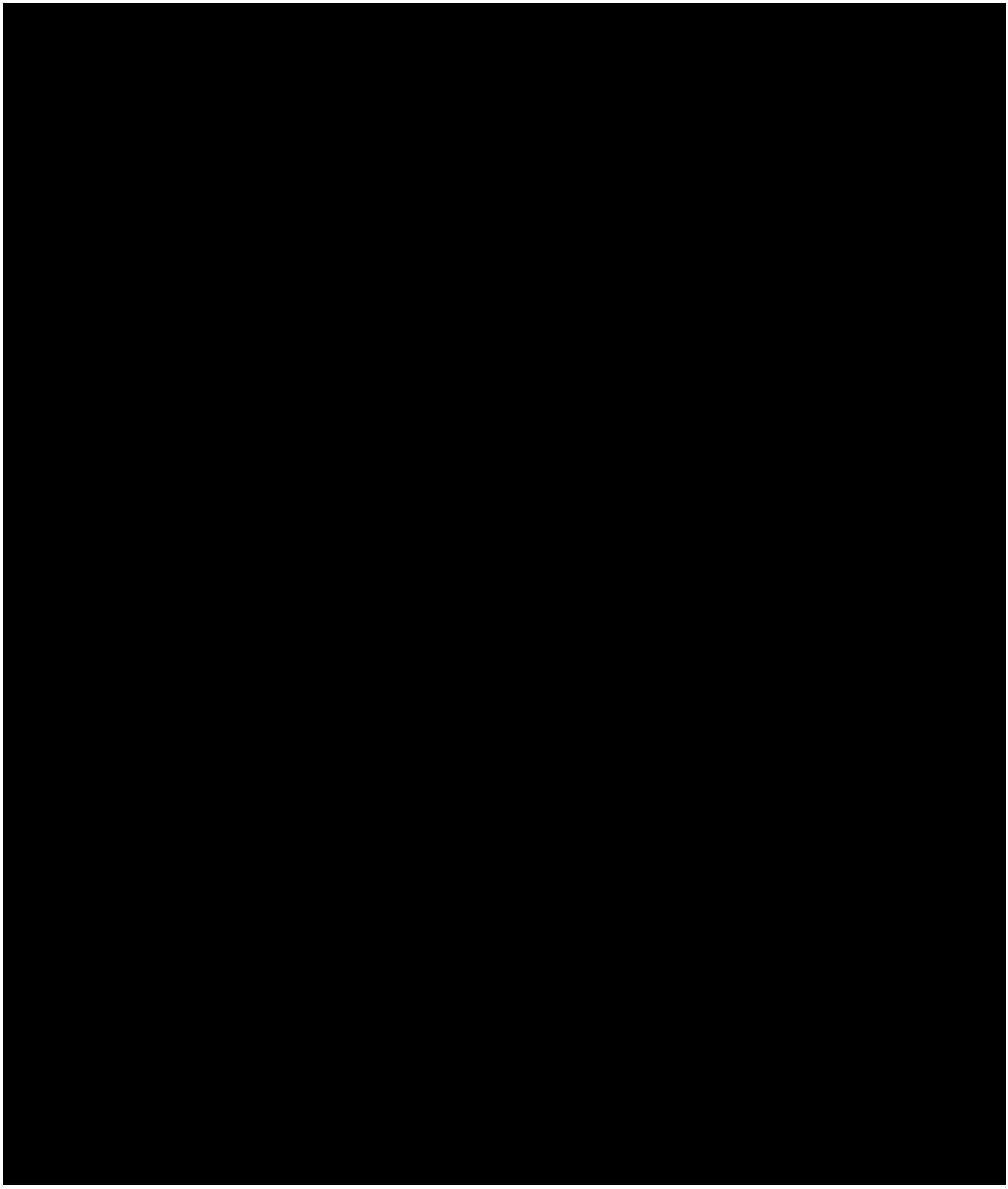


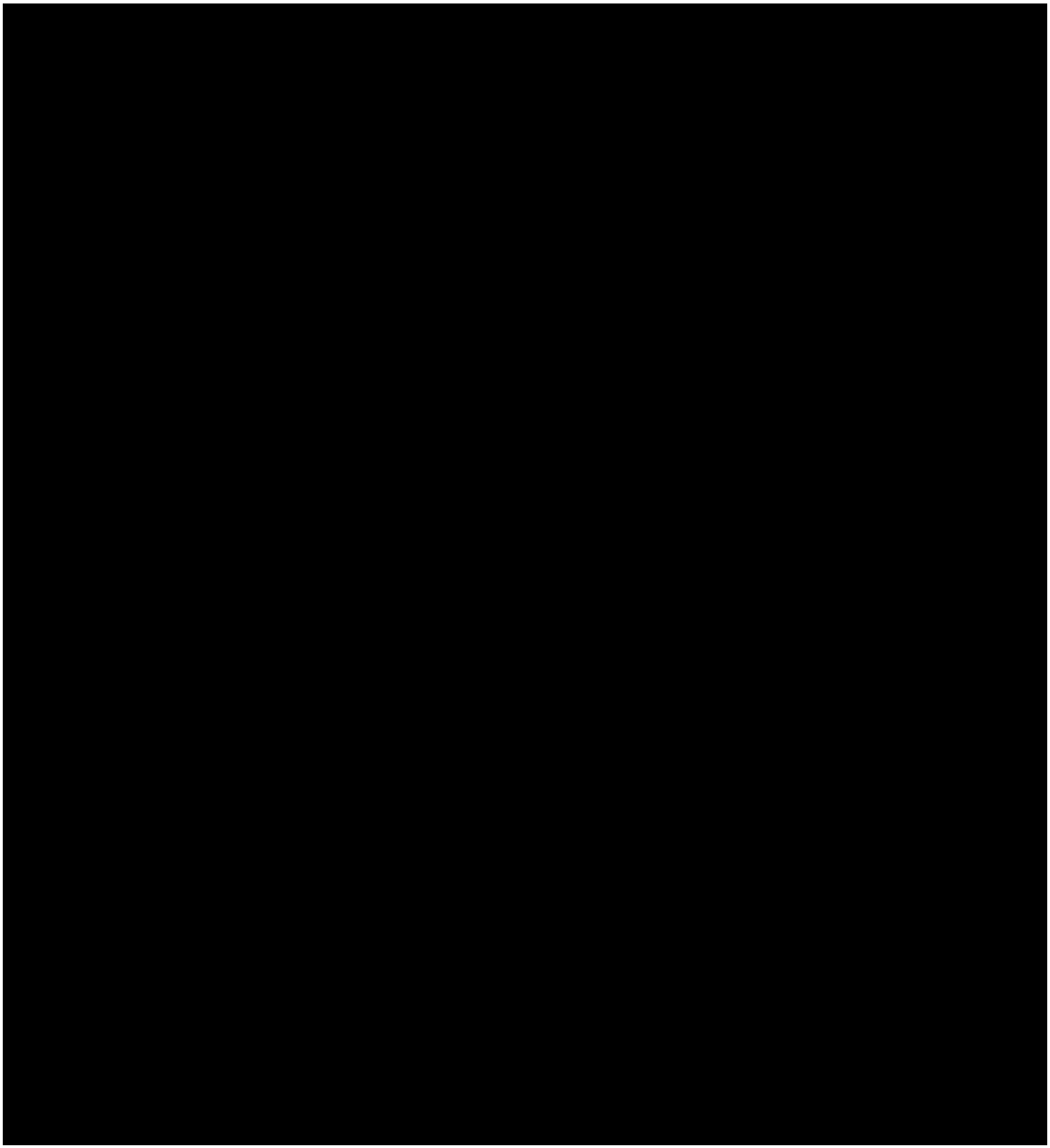


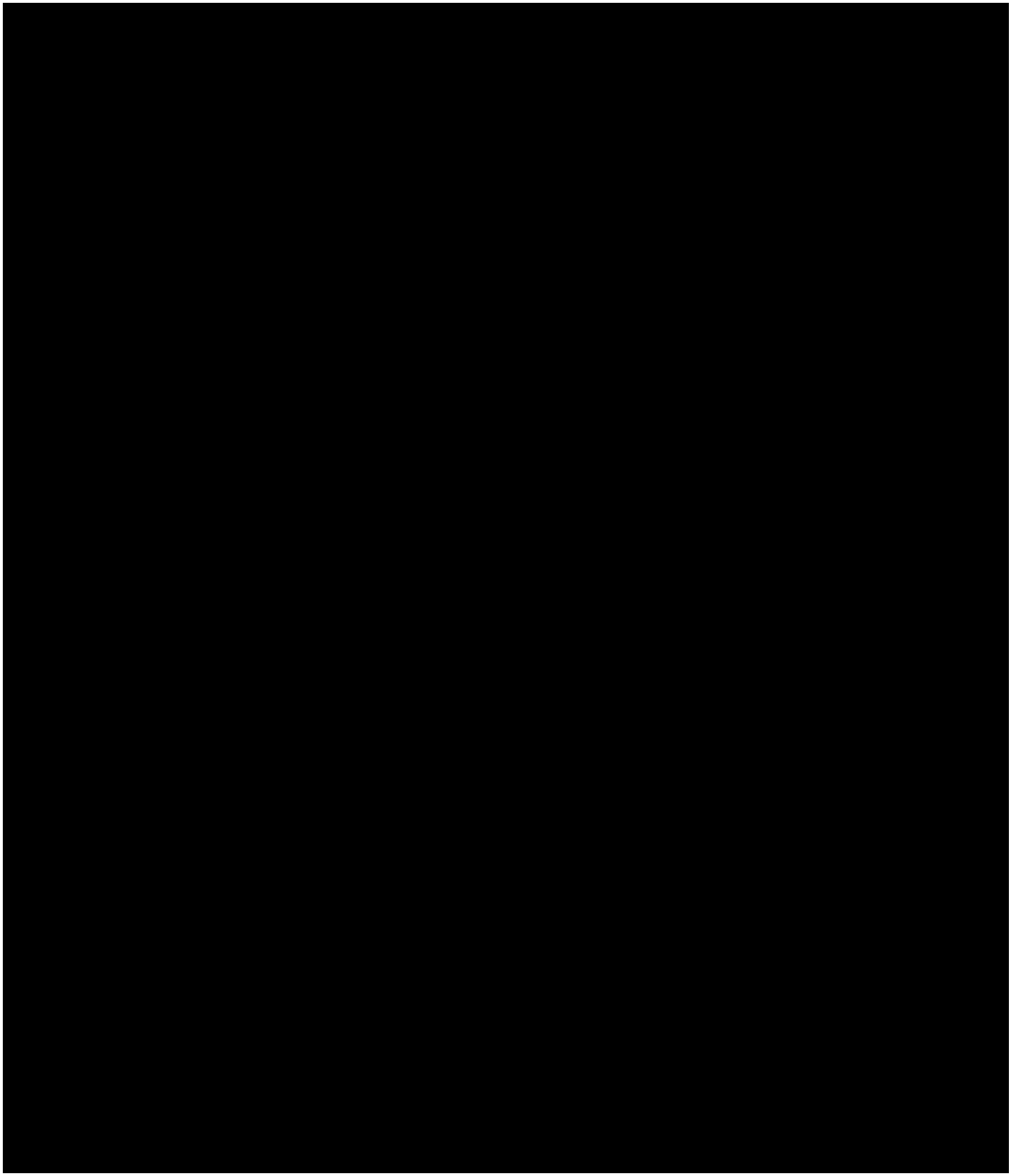


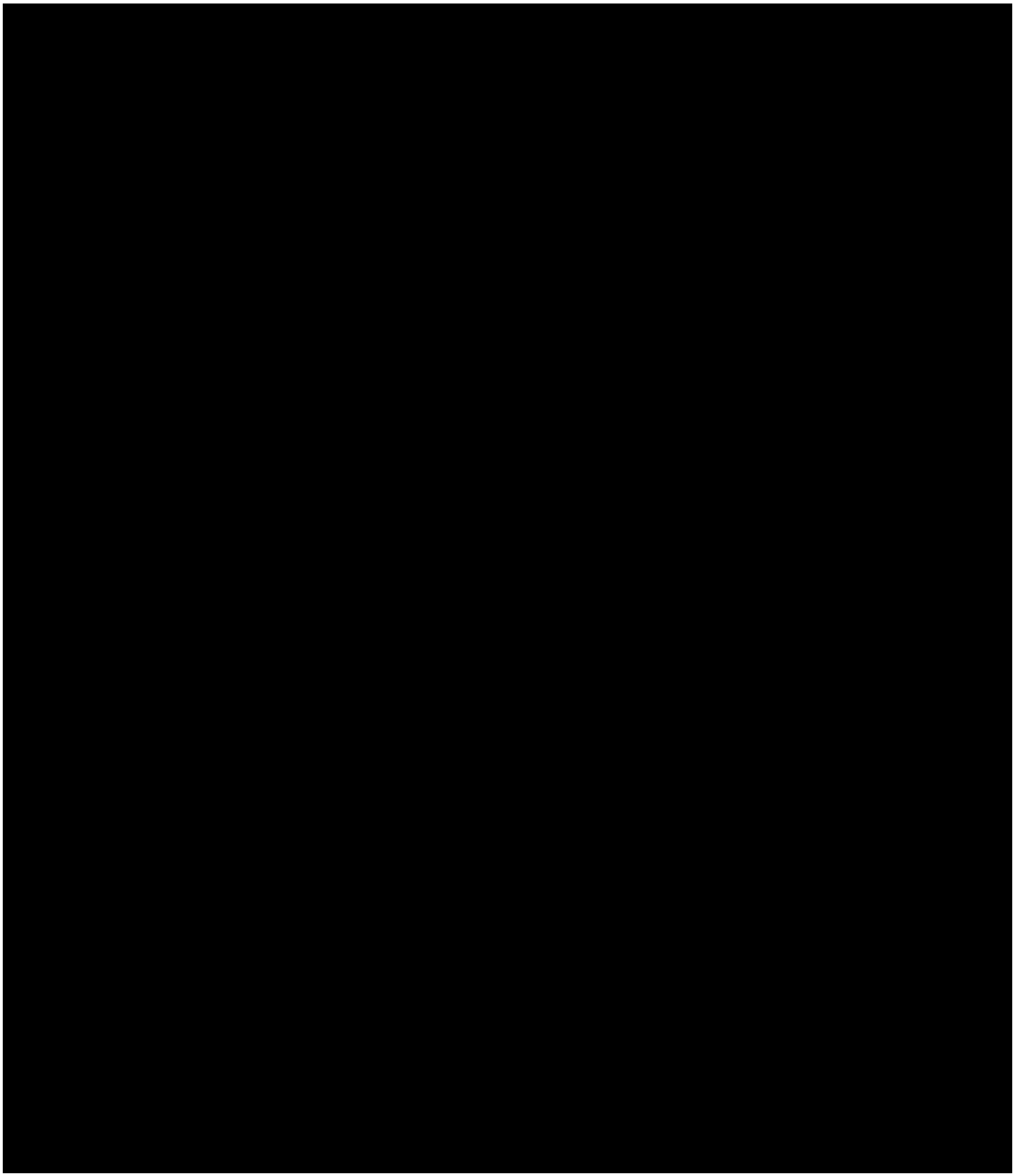


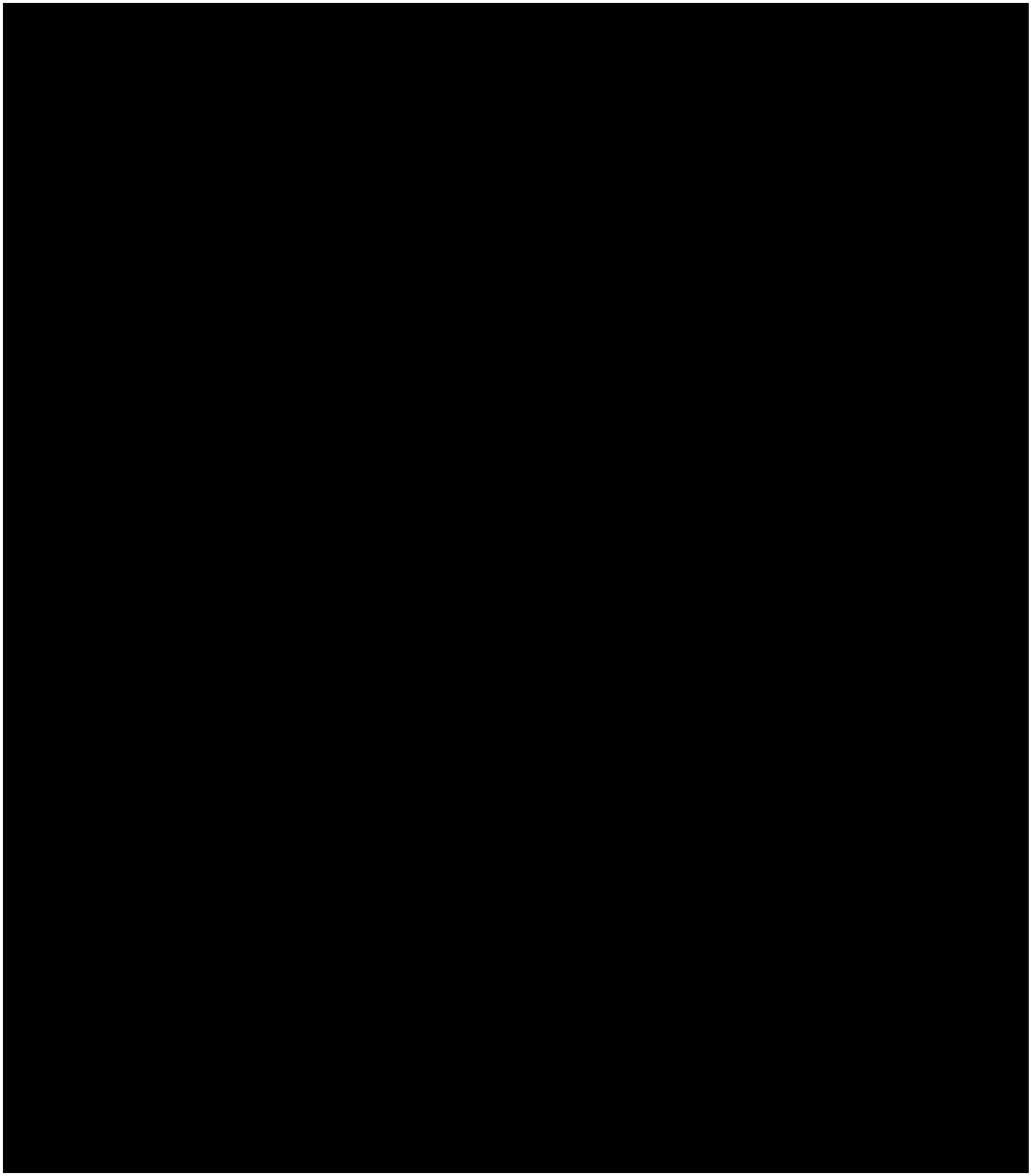


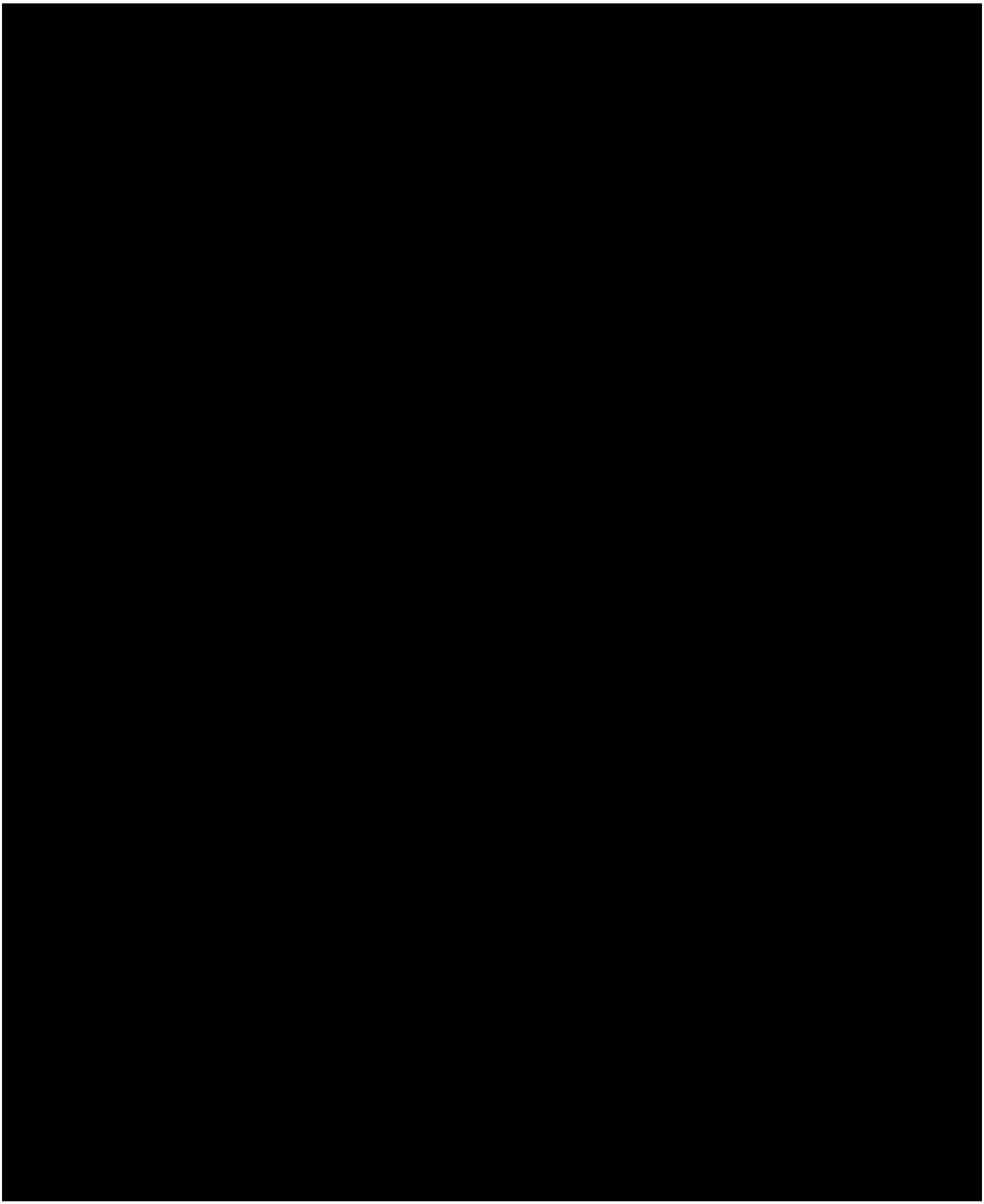


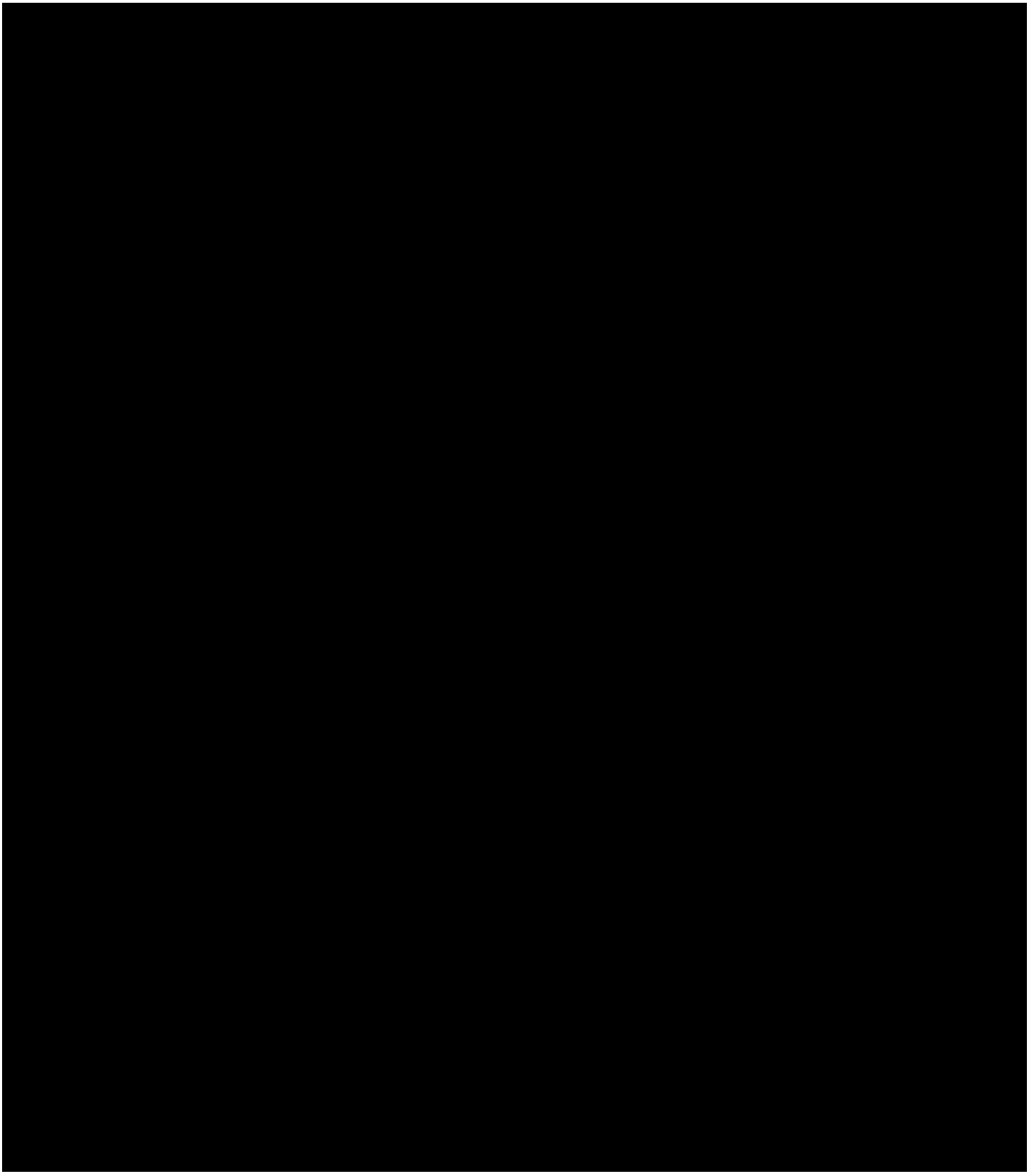


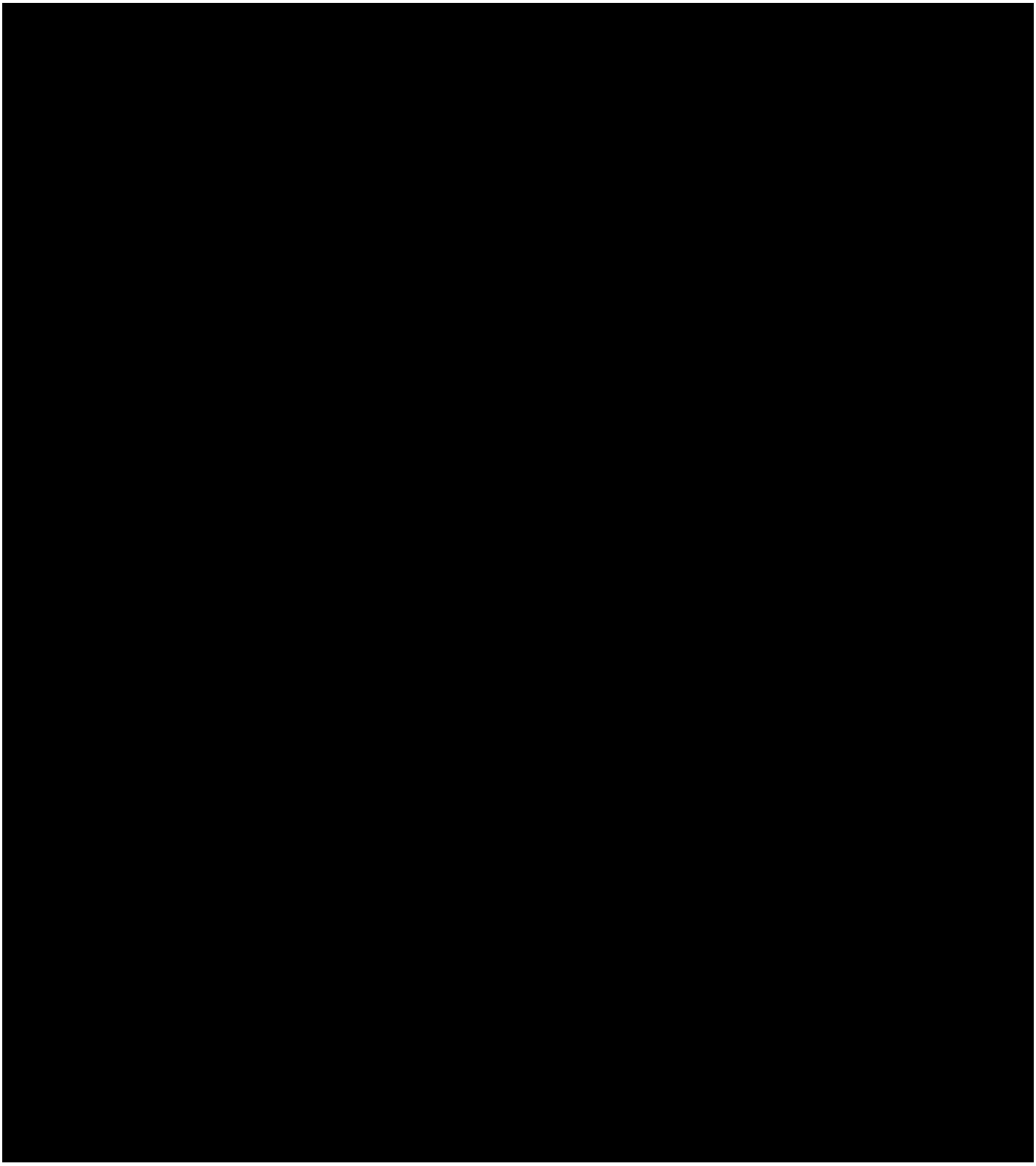


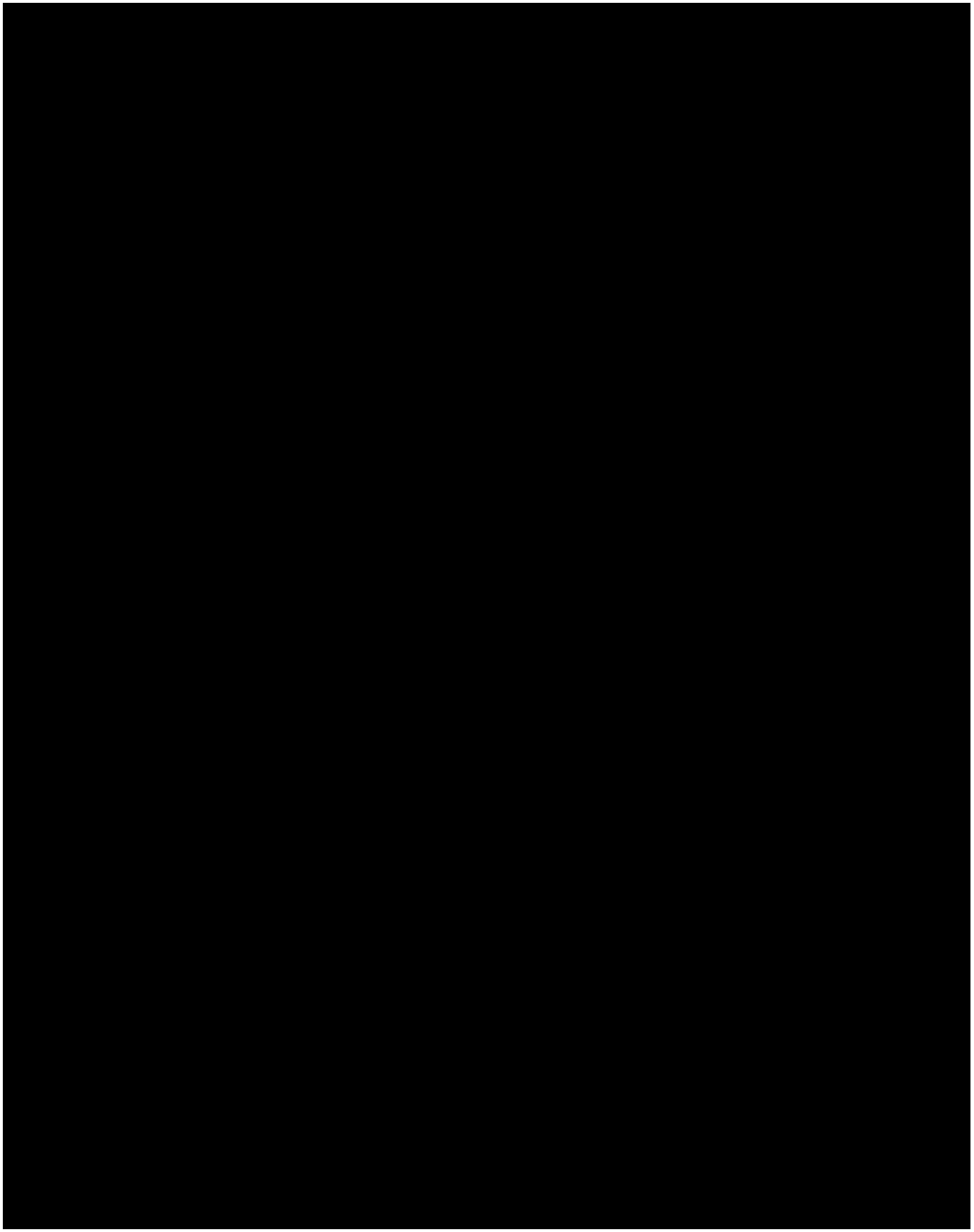




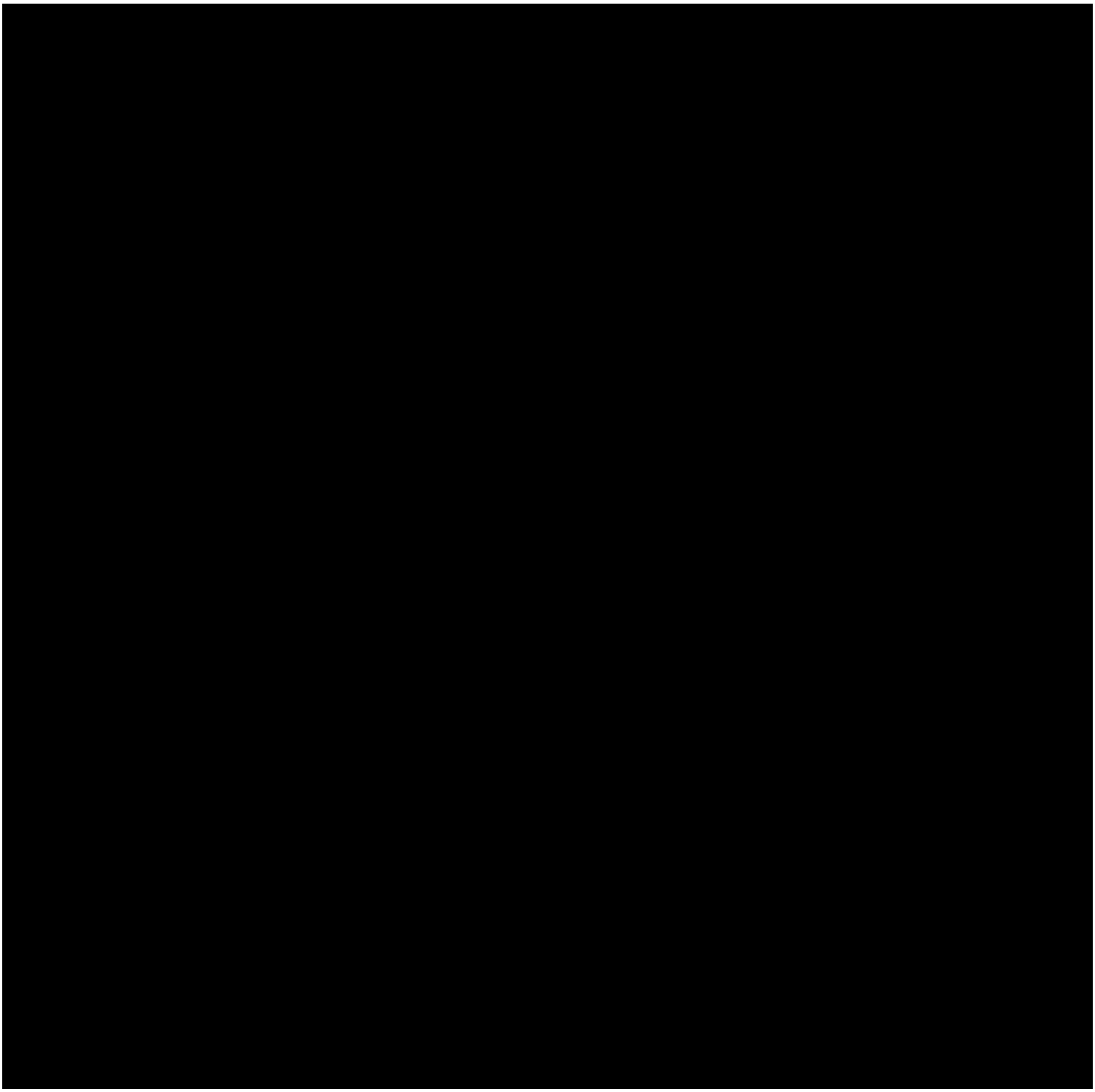


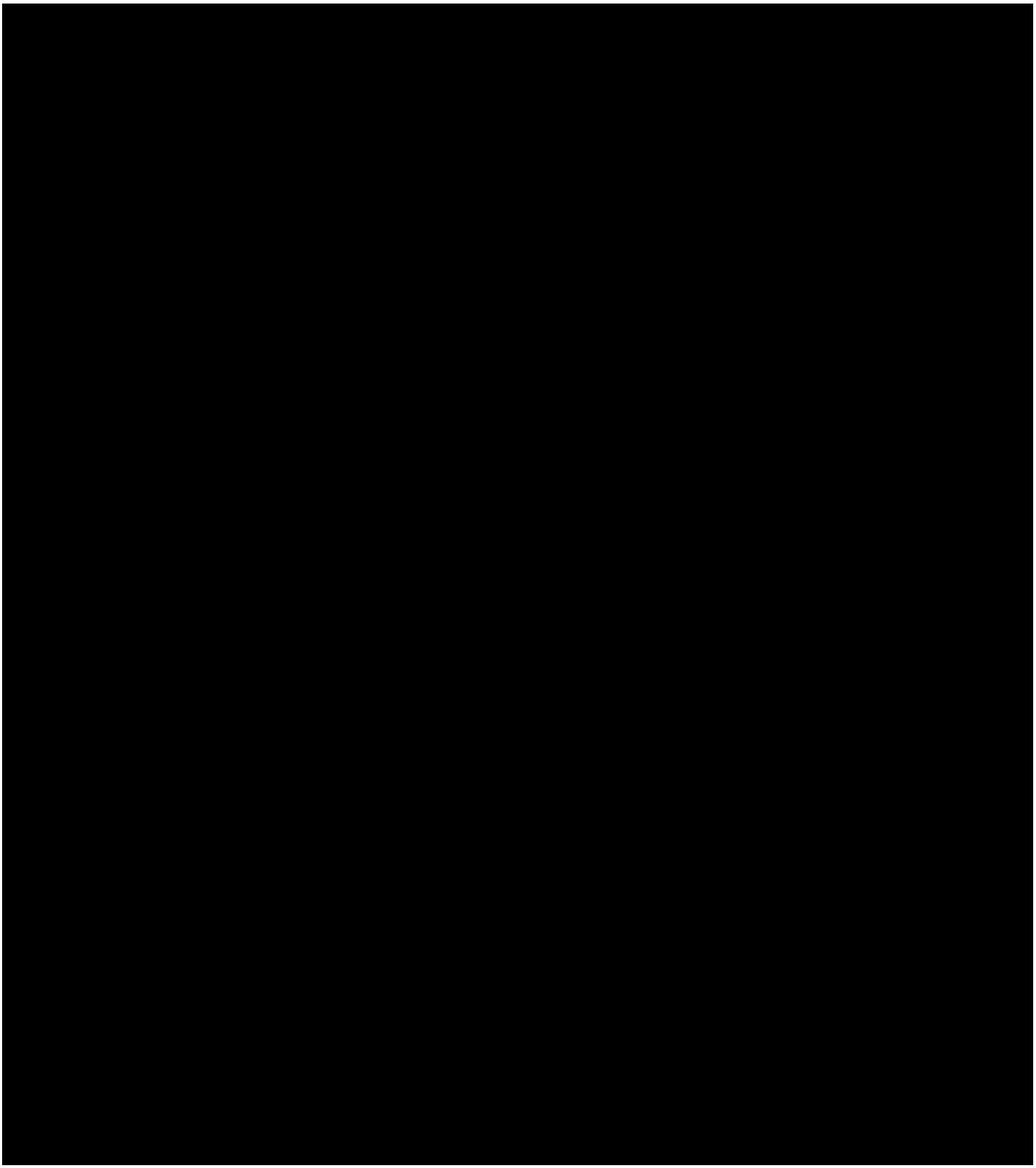




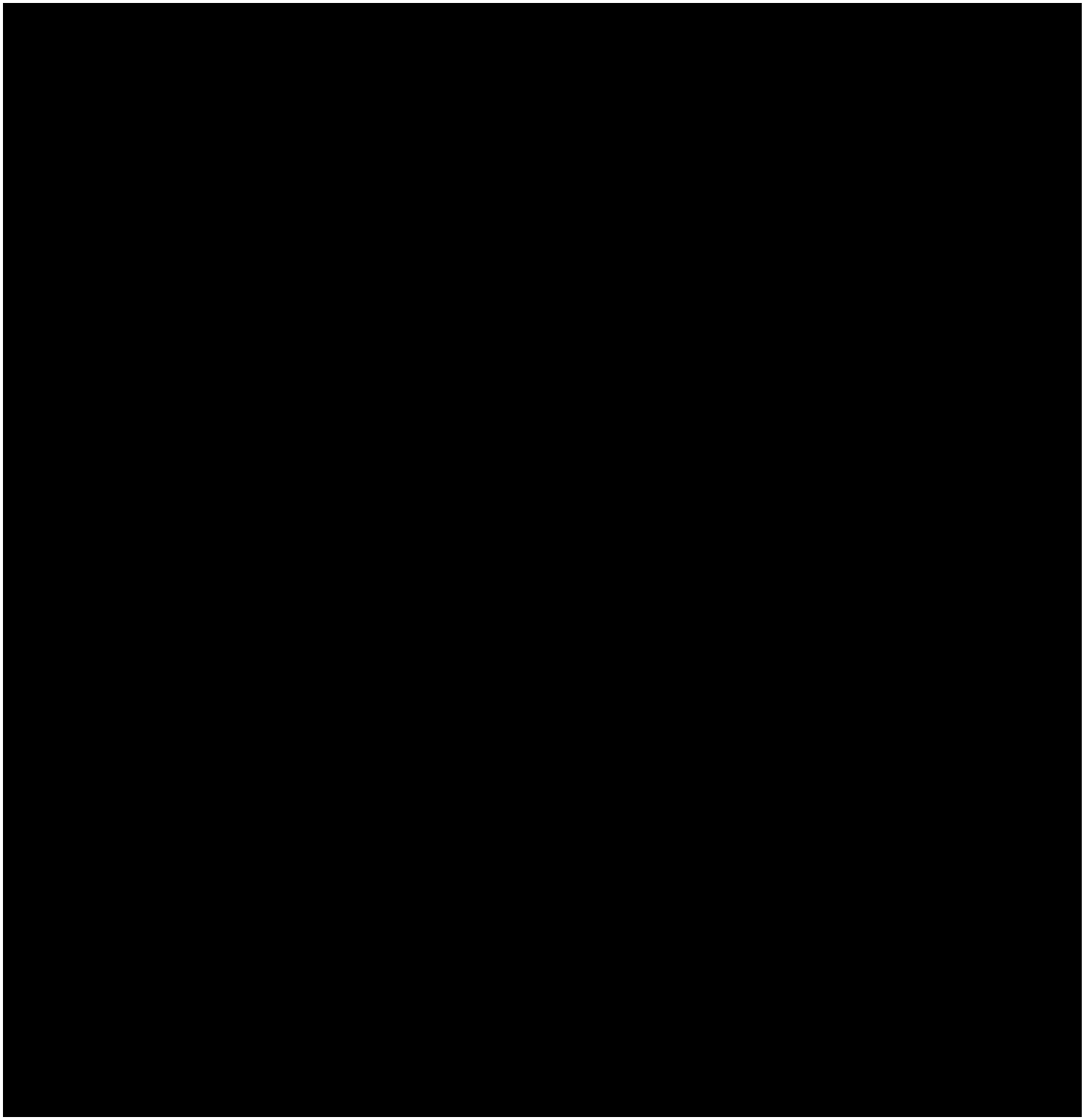


6 Preferred Option Recommendation





7 Conclusion



Appendix A – Glossary of Terms

A-Division comprises the original subway lines constructed by the Interborough Rapid Transit Company. A-Division train cars are narrower than those on the B-Division/BMT-IND lines, but both divisions have the same track gauge (standard, 4'8.5").

Bumper Block is a train stopping device installed on or near the end of a track to prevent trains from traveling beyond that point.

Communications-Based Train Control (CBTC) is a signaling system that uses telecommunications between the train and the track equipment to keep trains at a safe separation, manage train traffic, and ensure compliance with track speed limits. With CBTC, the exact position of the train is more accurately known than with traditional fixed-block signal systems. Within NYCT, CBTC has been introduced on the Canarsie Line (L train) and the Flushing Line (7 train).

Crossover is an interlocking between parallel tracks to enable trains to move from one track to the other. A Universal Crossover consists of an adjacent pair of crossovers (one behind the other), one with right hand turnout and one with left hand turnout. This enables a train traveling in either direction on either of the parallel tracks to cross to the parallel track. A Diamond Crossover provides the same crossover capabilities as a Universal Crossover but superimposes both the right hand turnout crossover overlay and intersects the left hand crossover to consume less linear track length than a Universal Crossover.

Deadhead train is a train that operates without passengers (out of service). Deadhead trains are typically used to move trains from yards to the start of service, to yards at the end of service, or to remove trains from service for scheduled or unscheduled reasons.

Fixed-block signal system is a signaling system that divides each track into different fixed-length blocks with a signal at the entrance to the block to govern whether it is safe to enter and occupy that block. This type of signaling system is the most prevalent type within the NYCT subway.

Gap train is a train that is on standby—positioned at key points in the system—ready to enter revenue service in the event of another train failure or due to a large gap in train service.

Line refers to the name of the infrastructure (e.g., Brighton Line).

Put-Ins refers to a non-revenue train entering revenue service.

Relaying trains is the repositioning and reversing of an out-of-service train from one subway track to another, usually to position it for another revenue trip.

Revenue train is a train that is in passenger service.

Route refers to the train services that operate over a line (e.g., B and Q trains operate over the Brighton Line).

Storage Yard is a place where trains are stored either during the middays and/or overnight hours.

Tail tracks are non-revenue (no passengers allowed) tracks where subway trains are either stored or turned back.

Turnout is a special track installation used to allow trains to proceed straight ahead or to diverge to another track. #XX turnout is the classification of a turnout by the inclination of the rail crossing contained in the turnout. Higher turnout numbers correspond to lower crossing angles and hence higher permissible speeds over that turnout. For example, a #10 turnout will permit trains to operate at a faster speed than a #6 turnout. Higher turnout numbers also correspond to longer turnout footprint length. A #10 turnout occupies a longer footprint than a #6 turnout. An Equilateral (Y-shaped) Turnout connects a center track to adjacent tracks on either side; thus, a train on the center track could access either of the two adjacent tracks.

Appendix B – Construction Duration and Capital Cost Estimate